AMERICAN MACHINIST

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Bement's Rotary Planing Machine.

The use of cutters mounted in a revolving disk for facing ends of columns, beams, &c., for bridge and other similar construction, is well known.

The machine which we illustrate is built for this purpose by Wm. B. Bement & Son, Philadelphia.

The disk, or cutter head, and its spindle are in one piece, carrying twenty-four cutters in a circle of thirty-six inches diameter. Each cutter is secured by set screws passing through a heavy steel band shrunk upon the cutter head. Power is applied through a worm and worm-wheel in the usual manner. The spindle bearing is in a transverse slide, which has an adjustment on the carriage proper of two inches for regulating the depth of cut. A screw is conveniently placed for making this adjustment, but is not visible in the engraving. Means are provided for taking up the wear in the various directions, so that the cutting may be done with steadiness.

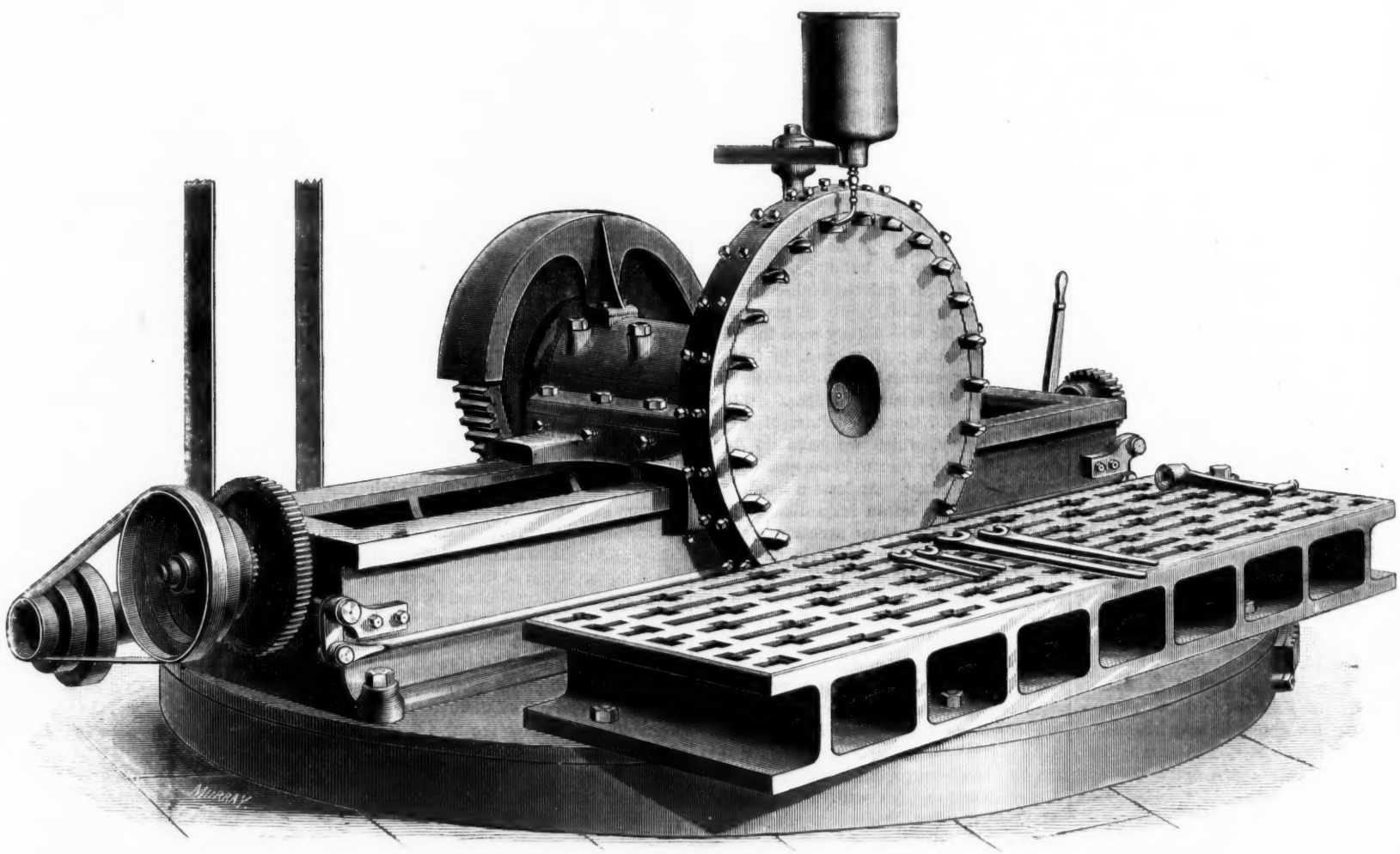
The cutters themselves are made from the square bar of steel, and each cutting point should have the same form and position, as referred to one side of the bar, and should project to the same distance from the face of the cutter head. Attention to this is necessary in order to secure good results economically.

Perhaps as convenient a method as any for grinding the cutters is on the flat side of an emery wheel, revolving on a horizontal spindle over a planed table. On the table, nearly under the wheel and parallel with its plane of rotation, should be fastened a guide strip. It is then easy to make a block for holding the cutters, the foot of which shall move in contact with the strip and give the cutters such form as desired. If the wheel is adjustable for a little distance in the direction of its axis, it makes the operation much more convenient.

The carriage has a variable feeding movement of seven feet on the bed, and a rapid return. Both of these are by power, and controlled by a single lever at the working end of the machine.

It is often necessary to face the ends of pieces forty or fifty feet long, and at various angles. Usually the bed of the machine is fixed, and the work placed at the required angle with it. For this, however, a considerable amount of floor space must be kept clear, while the handling is inconvenient and correct adjustment difficult. To obviate this, the machine which we describe is mounted upon a circular base plate of ten feet diameter, and can be swiveled through an angle of 90° by means of a pinion and segmental rack, the driving gear being so arranged as to permit this movement.

The required angle can therefore be obtained by adjustment of the bed, and the work always placed in one position, against stops or gauges. The graduations on the base plate, by which the angle is indicated, have a radius of nearly five feet, and the arrangements for moving and clamping are convenient. The adjustment can therefore be made quickly and accurately.



BEMENT'S ROTARY PLANER.

Use of Mild Steel in Boiler Construction.

BY GEORGE MARSHALL.

Since mild steel, as a proper material for the construction of steam boilers, is coming into general use, its nature and properties should receive more attention from mechanical and scientific societies in this country than is at present bestowed on the subject. While there is no doubt as to its strength being greater, and less care required in working than in the ordinary iron plate, yet there are many points to be considered besides these, and it must be done either by mechanical associations organized for that purpose, or else by the boiler builders of the country forming an association for the better understanding and development of steel plate in the manufacture of steam boilers. In England there are several organizations where the subject of steel in its different forms and for different purposes receives great attention, and much time, argument and study have been devoted to it by scientific and practical men belonging to these societies. The Institution of Naval Architects is, I think, one of the leading organizations in that respect, and the subject of steel for ship building, steel for forgings, and steel for boilers has received considerable attention, discussion and experimental tests from this society, or by their patronage.

"Lloyds Register" through their surveyors and engineers has also given the same question great attention, and in addition the Board of Admiralty has afforded the members of both societies ample opportunity to witness these experiments, or else have given copies of such experiments to advance the general knowledge of the subject of steel. Some of the papers read before the Institution of Naval Architects give instances where by the building of a boiler or boilers of steel and iron together, or by the use of iron rivets in a steel boiler, corrosion of the steel plate and the non-corrosion of iron have been the result. From this it is deduced that the uniting of the two materials forms a galvanic current injuriously affecting the steel plate. In the discussion following the reading of such a paper, however, instances were quoted where contrary results were observed, and the statement made that to the extensive use of manganese in the manufacture of steel, to insure a proper ductility, could a great deal of the corrosion be attributed, as it was a well known fact that by "the increase of manganese beyond a very narrow limit the steel becomes more corrosive, does not weld with the same facility, and is not so absolutely uniform as when little manganese is used."

The question of steel rivets in a steel boiler is no doubt a serious one, not as regards the chemical action taking place

between the two metals, or the unequal expansion of steel and iron (which I consider an absurdity), but to insure as near an equal strength in the entire construction of the boiler, as is possible to be obtained. Steel is now made in such a perfected state that there should really be no trouble in its manipulation, and I think one of the principal causes of trouble in the working of steel plate is owing to the fact that the majority of those engaged in working it have graduated in the strictly iron schools, and they expect to work a steel plate at a much lower temperature than is possible, when in the working of iron at the same temperature no risk was incurred. Braces, tubes and rivets of mild steel are the possibilities of the near future, and the surest way by which their exact properties can be determined is by careful tests on the part of mill men and the watchful scrutiny of the worker in this metal.

That the steel plate made according to the same process by different mill owners is not of the same nature is a fact well known to all who have had occasion to work it and carefully note the result. Some makes of steel are very hard, especially after flanging, and an experienced workman can readily tell which makes require annealing after flanging, and which do not. I do not think that annealing in all cases is required or that annealing in all cases is a benefit, because the facilities for such a process in most of our shops are primitive, and so uniformity of temperature (which is absolutely essential) cannot be obtained.

That the punching of steel (as commonly performed with the ordinary flat punch) is an injury to a plate, is a fact generally admitted, yet Dr. Siemens (the inventor of the Siemens process of converting steel) emphatically refutes this theory and claims that "mild boiler steel should bear any amount of rough work *in a cold* condition without receiving the least injury. If by punching mild steel you lose strength, I consider you have a clear proof that that material is not what it should be. So far from *diminishing* its strength, the very act of punching should increase the strength of the material. In fact, in any treatment to which mild steel is subjected, straightening or punching it or straining it in any one place, so as to alter slightly its form, the effect invariably is increase of strength, and not a slight increase either.

"It is therefore a practice with which I have little sympathy—that of annealing plates after punching." These remarks from such an authority should receive the greatest attention from steel plate manufacturers, and should, in my opinion, be thoroughly investigated by those whose duty it is to work such metal.

In regard to the question of steel rivets and their relative strength to those of iron, I would say here that in a test made by Park Bro. & Company, Pittsburgh, Pa., some years ago, with a steel boiler 40″ dia. 8 feet long, made of scant $\frac{1}{4}$″ steel, steel rivets being used, except in one place, where 6 rivets of iron were substituted, the shell increased in circumference $3\frac{1}{2}$″, and the test was stopped at a pressure of 790 lbs. to the square inch, the iron rivets having caused so much leakage that further test was impossible. By quoting the above test I must not be understood as endorsing the plate made by the firm mentioned to the disadvantage of other makers. I merely quote their experiment as a proof of the superiority of steel rivets. Notwithstanding the acknowledged superiority of steel over iron there are certain facts connected with its use which are considered mysterious by the boiler maker. In flanging a plate it sometimes happens that a sheet will crack at a point which should be considered too far from the expansion strain of the heat. The workman is astonished, and justly so. The foreman is consulted, and his astonishment is equal to that of the flanger. The true cause of these mysterious cracks is not fully understood; the supposition, however, is an imperfect distribution of the ingredients composing the plate.

The most mysterious of all the mysteries of steel plate is, I think, to be found in the case of the boilers built by Messrs. John Elder & Company, Scotland, for the Imperial Russian yacht, Livadia. These boilers were of cylindrical form 14 ft. 3″ dia., 16 ft. long, made of $\frac{3}{4}$″ steel; 8 double ended and 2 single ended boilers being required in this vessel. From a report made in regard to the boilers, the sheets were punched, slightly heated, bent to the required curve, and the holes reamed out to the finished size required. The holes originally were punched $\frac{1}{16}$″ smaller than the diameter of the rivet and the reaming was necessary to insure fair holes as well as to remove the effects of punching. On subjecting the first boiler to pressure and before the maximum (140 lbs.) was reached the shell tore asunder in three places. The second boiler was found to be cracked in a like manner *before any water was put in it*, the defects in both being behind, not in, the rivet holes. The plates were all annealed previous to their being placed in the boilers, but the annealing process was imperfect, from the fact that eleven plates were placed one on top of the other, and a greater heat was experienced at the edges than at the center of the middle plates. There was no proof adduced that the middle plates were the defective ones, still it seems natural to suppose that such was the case.

In a future paper I will give your readers the results of tests and theories in regard to the mysterious cracking of plates.

The Brown & Sharpe Manufacturing Company's Shops.

It would not probably be beyond truth to say that the shops of the Brown & Sharpe Manufacturing Company, at Providence, R. I., are the best constructed, arranged and equipped of any of the kind in the world. Fortunately situated with regard to room on all sides, no efforts or means have been spared in erecting the buildings, in making all the rooms light and cheerful, and in fitting them in the most approved manner for the purposes for which they were intended. The ventilation is perfect, and, in fact, all sanitary arrangements are superior to those of the majority of private residences. All these things called for the expenditure of a good deal of money, which we have no doubt yields satisfactory returns in the quantity and quality of product. At least a lesson that may be learned by an inspection of these shops is, that there is no necessary connection between machine work in any of its branches, and low, unhealthy, ill-lighted, dirty rooms, where workmen must expend 50 per cent. of their available energy in an effort to exist.

In these shops, as might be expected, the use of special tools is brought as nearly to a state of perfection as is practicable, and no one observing their use will have any difficulty in seeing how important a factor they are in the cheap production of good work. A good deal has been written and said on this subject; but, while enough may be understood about it in a general way, too little is known specifically. The Brown & Sharpe Company were, we believe, the first to introduce limit gauges for use in the inspection of finished work. Previous to this the matter of making work to gauge, where the work had to pass through the hands of an inspector—as it should do—was hedged about with a good many difficulties. Particularly this was so when the work was for the United States Government, and had to pass Government inspectors, when, sometimes, the caprice of the inspector was not one of the least difficulties. To make a piece so that an inspector will, by the use of a single gauge, admit that it is just right, is, as any mechanic understands, one of those things that are possible, but not probable. A limit having been established, a variation beyond which is not admissible, by the use of two gauges the difference in the size of which is just equal to this limit of allowable variation, the personal equivalent part of the business is eliminated, the work standing on merit and not on opinion. In almost any machine work, except measuring instruments, a certain minute variation is admissible. Of course, the greater this limit the cheaper the process of manufacture. But there must be no guess work about it, and time must not be wasted in determining whether or not this limit is exceeded. Some such considerations as these led this firm, long ago, to establish for certain parts of their works, particularly for sewing-machine work, the use of these limit gauges, one of which must go through or over the piece under inspection, while the other must not. This limit may be one-thousand or the ten-thousandth of an inch, or anything else that is determined by a consideration of the circumstances.

In very few, if any, shops is such use made of accurate grinding machinery, both for circular and plane surfaces, as is made here. Not only hardened cylindrical surfaces, and soft surfaces that must fit accurately, and be truly cylindrical, are submitted to the grinding process, but in many instances work that only requires bringing to a fair condition in these respects is ground, because it is the cheapest way to accomplish the purpose. Grinding machines for cylindrical work are comparatively inexpensive, and could be advantageously used in nearly every machine shop to a much greater extent than they are. The idea that the grinding process, and a good many other special processes, are only valuable in large manufacturing establishments, is one that a little investigation would satisfy a good many is a mistaken one. At the Brown & Sharpe Works a room is devoted to grinding processes, and a good proportion of the turned work finds its way there to be brought to gauge by this means. In flat surfaces hardened work is ground true, smooth surfaces brought up, and delicate castings that will not bear clamping sufficiently to resist the pressure of a planer tool, or that are chilled so that they cannot be cut with a tool, are comfortably operated upon by the grinding machine for plain work. As an instance of the degree of perfection to which it is possible to bring work by grinding, the writer was shown a pair of plates more than twelve inches square, faced with steel $\frac{1}{2}$″ or $\frac{5}{8}$″ thick, "burned" on in the mould and hardened outright, the surfaces of which were ground on a surface-grinding machine so perfect that the upper plate will lift the lower one after the manner of well-fitted surface plates, which they are, with the exception of being several times heavier than ordinary surface plates. Speaking of surface plates, this firm have, in their systematic manufacture, established a fact probably not generally known, which is this: These plates are made in quantities and stored for shipment on orders, and it is found that a plate or a set of plates, taken from the casting-room and accurately surfaced and laid away, will, when taken out to ship, generally require a small amount of correction, there being a strong probability that after the first finishing the plate will, probably by contraction and expansion from slight changes of temperature, spring a little out of truth. It is unnecessary to add that this is always attended to, and it is not probable that after being brought up true the second time—some weeks after the first operation—there will be any further trouble from this cause.

The large number of hand lathes used in these shops is likely to strike one as remarkable. These lathes, with hollow spindles and shell chucks in which work can be clamped and released without stopping, and with the little tool holder for turning small work straight or tapering without time spent in adjusting and applying, play an important part in cheapening product. The hand-lathe is not used to nearly so great an extent as it should be in this country.

All work made is systematically inspected, the larger work on the floors and the smaller in rooms devoted to the purpose. For example, the Wilcox & Gibbs sewing machines, of which a large number are made, all pass, when completed, to the inspection room, along and just outside of which extends a shelf reached by an opening from the room extending all along the shelf, and just large enough to admit of passing a machine out. The inspectors are provided with a variety of printed tags, each bearing an inscription of some possible malady. If the inspection discloses any fault the appropriate tag is affixed, and the machine set out on the shelf. No argument is necessary, nor time spent in explanation, but the part that is wrong is corrected, and the machine returned for a second inspection.

The production of accurate cutters for the teeth of gear wheels forms a part of the business of this firm, and one that has received a good deal of attention, and employ a good deal of skill. The process cannot be described in an article the length of this, but the plan can be outlined in a few words: The first process is to determine the boundary lines, or the curves of the teeth. This is done by means of an ingeniously constructed machine called the "Epicycloidal Engine." By the use of this engine exact curves for any desired pitch are traced on metal, the lines—as fine as can be made—thus traced forming the basis of comparison through the several processes in the formation of the tools that are to shape the blank for the cutter, or, as to that matter up to the completion of the cutter. The final tool that gives the shape to the cutter is of such construction as to permit correction for spring in tempering, if found necessary. As all through the process the curves traced by the engine, which are as near *lines*, geometrically speaking, as it is practicable to make, are used for comparison, and as the construction of all tools is such as to admit of exact comparison, any error too small to sensibly affect the result can be readily observed by the use of a strong glass. Finally, the completed cutter can be compared with these curves. Of course there is nothing in this that requires anything more than good, accurate work, but it is a kind of work that requires, along with skill, considerable time and patience. As an evidence of how accurately this class of work is done, we saw templets—male and female—originated from the curves traced by the epicycloidal engine, made of steel about $\frac{1}{8}$″ thick, and so accurately that they could be reversed without showing light anywhere along their joints.

The foundry is one of the noticeable features of the Brown & Sharpe shops. A smooth concrete floor in a foundry is uncommon enough, but such a floor, when not in actual use, kept swept as clean as an office floor is something more than uncommon. Of course the sweeping process implies another novelty in foundry practice, viz: places for tools and appliances and such things kept in place. The foundry building is warmed with steam as comfortably as the machine and other shops, and like the other buildings is built from an appreciation of the fact that if daylight is not cheaper than gas light it is better. Being situated across a street from the other buildings, a tunnel is built under the street connecting the yards. At the side of the foundry yard is a substantial bank wall, the ground beyond being graded several feet higher. Under this higher ground are vaults arched back from the wall, and in these vaults are kept the foundry stores. The foundry yard is level on this side with the cupola staging, so no elevating of coal and iron is required. The foundry cranes are worked both by power and by hand. Four moulding machines are used for special work, and the castings made, more especially the light ones, are as fine as are seen in the country. In addition to their own work, a good many castings of the finer class are made for other parties. Excellent facilities for pickling, cleaning and annealing castings are provided. The core room is arranged with an overhead track and traveling crane, by which a heavy core can be taken from any part of the room, or from the oven, and deposited in any other part.

The sanitary conditions have been referred to. In these are included closets ventilated from a flue in the chimney, so that absolutely no foul air can escape into the room, and "washing up" rooms connected with rooms for the use of workmen and in which they hang up clothing and deposit other property, each one's location being plainly designated.

For washing, the troughs are divided longitudinally by a central trough, which always contains clean water. The floors and all parts of these rooms are kept scrupulously clean. In addition to these facilities, the foundry building is provided with a number of bath rooms, so that if one is so minded he can go to and from his work in his "Sunday suit," taking his bath and changing his clothing at the shop instead of at home.

When these shops were built there was, as is generally the case, an intention of enlarging them, which was fully provided for by locating posts and beams (iron) in the walls that new buildings would adjoin. The wisdom in this is apparent, when it is seen that the bricks for enlargement are on the ground and the iron work being prepared with which to commence the enlargement early in the spring.

New Prony Brake.

At the recent fair of the American Institute, two students from the Stevens Institute —Messrs. Mitchell and Aldrich—made a partial test of the Straight Line Engine then on exhibition, and the Prony brake used embodied some features we had not seen before, and we herewith produce a cut of it from a sketch furnished us by the Straight Line Engine Company.

It is of the ordinary belt kind, with blocks of pine wood bound to the face of the iron pulley by two leather bands, though band iron hoops are better, as the stretch of the leather calls for more constant attention. It will be seen that the force exerted to overcome the friction between the pulley and the friction blocks is transmitted to the platform of an ordinary scale, by the end of one of the arms resting on the top of a small roller, supported by the stand set on the scale.

wheels come to rest. Pieces of salt pork, secured between the blocks, furnish a constant supply of grease, increasing as the temperature of the pulley increases. With this brake, the pulley of which is 42″×7″, a test of 30 or 40 horse-power may be made, and continued for any length of time.

In the test mentioned one or two points were brought out in regard to the engine. First, the great accuracy with which the speed was controlled, there being a variation of but two revolutions both by a change from no load to 55 horse-power, and with a variation of several pounds in the steam pressure. The engine tested had an 8″×14″ cylinder, was run from 230 to 232 revolutions, and the steam pressure ranged from 60 to 80 or 90 pounds. The friction as determined by deducting the work recorded by the brake, from that shown by the indicators, varied from 100 per cent. when running light to $4\frac{3}{10}$ per cent. when doing 55 horse-power of work. In fact the actual work required to run the engine was very nearly constant, being $\frac{1}{10}$ of one horse power less at 35 horse-power than at 6 horse-power and 55 horse-power. This condition, Prof. Sweet argues, agrees with his theory that the compression was, as it ought to be, viz.: just what will arrest the reciprocating parts and start them back, relieving the crank pin and bearings of all the friction possible while the engine is passing its dead centers.

It is a common thing to recommend the use of the indicator, but its work combined with the Prony brake, or some other means of determining the amount of actual work performed, becomes far more valuable, and had we some ready means of determining the actual amount of steam used, or perhaps we should say the character of the steam used, both the indicator and the Prony brake would settle points in engine construction and economy much more conclusively. To determine the amount of water used it may be measured, as it is pumped into the boiler, or condensed as it leaves the engine, but to determine how much of it goes into the engine in the form of steam, and how much as water, is not so easy, as the present known methods are not so uniform under like conditions as to give confidence in their accuracy.

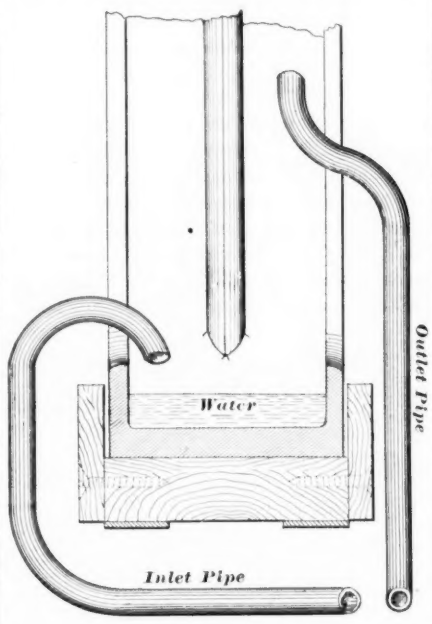


Fig. 2

Heroic Devotion to Duty.

The Pittsburgh *National Labor Tribune* relates an exciting incident of the recent floods which shows a heroic devotion to duty displayed by workmen, that is well worthy of record. On Wednesday afternoon while seven or eight workmen at the steel works of Hussey, Howe & Co., of Pittsburgh, were at work, the water crept up to the main building and warned the inmates that they had better vacate. These men had a heat in one of the open hearth furnaces. It was not ready to take out, yet should the water strike it in that shape an explosion would follow. Knowing this the men determined to obstruct the flood till they finished their heat. They built an embankment round the furnaces, and went on with their work. In places the water oozed through, but they plastered the leaks and persisted in their labors. Just as they got the heat out the rising current swept down the whole embankment and surrounded the workers, who waded out, after having performed the service of preventing an explosion. Many other furnaces were less fortunate, and were badly damaged by explosions, resulting from the water flooding the molten metal.

Engines of Manganese Bronze.

Messrs. W. H. Allen & Co., of York Street Works, Lambeth, S, E., have just completed two sets of pumping engines for salvage purposes, in which the parts usually made of steel—that is, the piston rod, connecting rod, crosshead, crankshaft, pump spindle, eccentric rod, eccentric strap, and valves, as well as the bolts and nuts—are of manganese bronze. These engines have been made for one of the leading salvage companies in the north, and have been designed to prevent the loss of time which frequently occurs in raising ships which are only partially submerged at low tide. In such cases the machinery has sometimes to remain under water for several days together, until advantage can be taken of a low tide to pump out the ship. With steel working parts, great difficulty arises from the journals of the shaft becoming oxydized to such an extent as to cause a quantity of minute particles of steel rust to remain in the bearings. Immediately the engines are started, seizing takes place, and then a complete overhaul has to be made, during which time the opportunity is slipping away, and when matters are put right the rise of the tide stops the work. Great difficulty was experienced in obtaining a suitable metal to form the bearings for the forged bronze to work in, and many alloys were tried before one was found which fully answered the requirements. The alloy now used is a hard mixture, which runs at high speeds without heating, and wears in a short time to a smooth and glassy surface. The strength of forged bronze is about that of mild steel (29 to 30 tons per square inch), so that nothing is lost by the adoption of the new metal. There is every prospect that there will be a considerable demand for these engines, particularly for this branch of salvage work.—*Engineering.*

A correspondent would like to hear from some reader of the AMERICAN MACHINIST, who has had experience in their use, as to the best way of fastening and the wearing qualities of cotton belts.

The first iron planer constructed in this country is said to have been made by Thomas Hill, Providence, R. I.

Charles J. Leach & Allen Olds, Hartford, Mich., have patented a traction engine, which contains some curious features. The cylinders are fastened in a horizontal position on top of the boiler, and connect with a shaft, which reaches across the top of the fire-box. On this shaft are gear wheels, which connect with gears on an intermediate shaft running through the fire-box. These gears in turn connect with toothed wheels on the driving axle. The front end of the engine is carried by a single wheel resembling an enlarged castor.

Fred. W. Richardson, of this city, has presented to the Rensselaer Polytechnic Institute a beautiful model of the "link and valve motion" of the locomotive. The model, which is similar to those Mr. Richardson is manufacturing for the use of the master mechanics of some of the largest railroad corporations of the country, illustrates perfectly the link and valve motion of the locomotive under all possible practical conditions, and is valued at about $450. The gift, which was entirely unsolicited and unexpected, is thoroughly appreciated by the institute authorities.—*Troy (N. Y.) Times.*

This machine was illustrated and described in the AMERICAN MACHINIST of May 26, 1883.

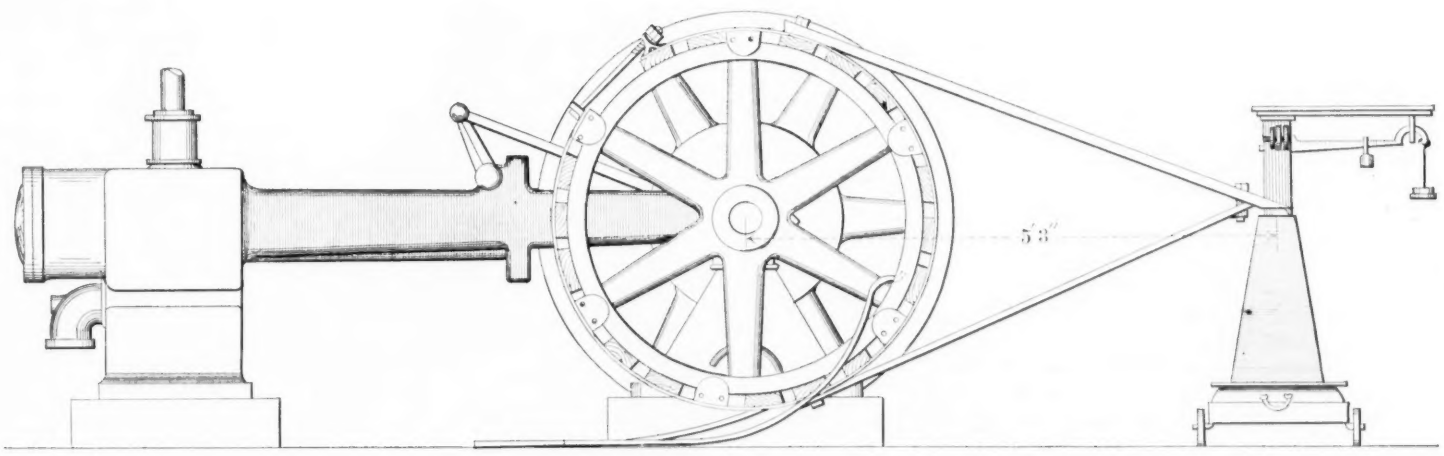


Fig. 1

NEW PRONY BRAKE.

The top of the roller is level with the center of the shaft, and just five feet three inches from it, and when once set the radius will not vary, however much the brake blocks may wear. The circumference of a circle, whose radius is five feet three inches, being 33 feet, the distance selected is one that saves many figures in calculating the results; for, instead of multiplying by 33 feet, and then dividing by 33,000 to arrive at the horse-power, it is only necessary to divide by 1,000. Thus, all the figures that are necessary is to multiply the number of revolutions by the pressure on the platform, and divide by 1,000, the weight of the stand and levers having first been counterbalanced.

The pulley is made as shown in Fig. 2, with a flange on each side projecting in about two inches, forming a circular trough, into and out of which a stream of water is kept flowing. The water enters through the inlet pipe, fixed to deliver the water on one side of the arms in the direction the wheel is turning, and the outlet pipe, scoops out the water after it attains any determined depth. Just before stopping the water is shut off, and the outlet pipe crowded out, until it comes in contact with the inside of the pulley, so that nearly all of the water is removed, and splashing prevented when the

Improving the Steam Whistle.

We note the information that the Chesapeake & Ohio Railroad Company are putting steam-boat whistles on all their passenger locomotives. They are said to be regarded by the public as a decided improvement since they indicate on the approach of a train whether it is passenger or freight, and because they can be heard from a very great distance. If this is the kind of improvement that brings pleasure to the people along the line of the Chesapeake and Ohio Railroad, they must have curious tastes. If any improvement on the steam whistle is desired by people in other sections of the country it is certainly not in the direction of increasing the noise. There are a great many people along railroad lines, who would consider an improvement that abolished the steam whistle altogether as a most desirable change. Some engineers appear to derive intense gratification from hearing their whistles howling at their loudest roar on all occasions when they have any excuse for pulling the valve open, and these men inflict untold torture on invalids and people with a susceptible sense of hearing. By all means let us have whistle improvement, but let it be in the direction of silence.

The *Mexican Financier* tells its readers that the United States style of passenger car is much safer for travelers than the light cars used in Europe and introduced into Mexico on the Mexican Railway. The doors on the sides are proved to be dangerous, not only by letting passengers fall out while the train is in motion, but by weakening the car so that when a collision happens the car doubles up. For this reason they are abandoning the English form of car on the Mexican Railway, and adopting those of American make. All the other roads in Mexico used the American style of car from the start.

The Milling Machine: Its Construction and Uses.

By John J. Grant.

SEVENTEENTH PAPER.

For most of the cuts illustrating this article, as well as for the table of spirals and angles, I am indebted to the Brown & Sharpe Manufacturing Co. They are taken from the Treatise on the Universal Milling Machine, published by them. The directions for setting the machine and cutters for grooving twist drills are also taken in part from the same source.

In cutting a twist drill, the arbor requires to be quite long, as the bed of the machine has to be turned around to correspond to the required angle of the drill. I would recommend an arbor shaped like the drawing, Fig. 1. This arbor will be found very useful for a great many other purposes than this one job, as all work requiring a spiral necessitates the use of a long arbor. The arbor should be made as large as the full diameter of the center hole of the machine at its outer end, and tapered to about $\frac{7}{8}''$ diameter near the cutter, and should be made of either tool or very stiff machine steel, as the distance out from the end of the spindle is necessarily great, and the arbor requires all the strength that it can possibly have.

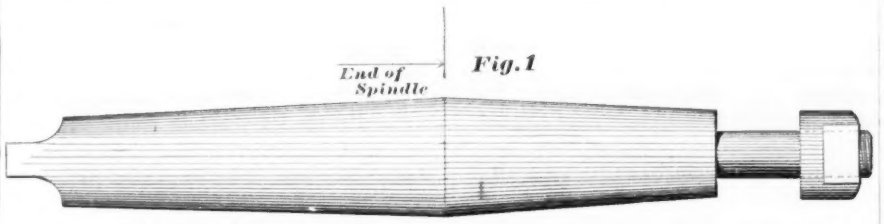


Fig. 1

Arbor for Spiral Cutting

Diameter of Drill.	Thickness of Cutter.	Pitch in Inches.	Angle of Spiral.
1-16 in.	.06 in.	.67	16° 20′
1-8 "	.08 "	1.12	19° 20′
3-16 "	.11 "	1.67	19° 25′
1-4 "	.15 "	1.94	21°
5-16 "	.19 "	2.92	20°
3-8 "	.23 "	3.24	21°
7-16 "	.27 "	3.89	20° 10′
1-2 "	.31 "	4.17	20° 30′
9-16 "	.35 "	4.86	20°
5-8 "	.39 "	5.33	20° 12′
11-16 "	.44 "	6.12	19° 30′
3-4 "	.50 "	6.48	20°
13-16 "	.56 "	7.29	19° 20′
7-8 "	.62 "	7.62	19° 50′
15-16 "	.70 "	8.33	19° 30′
1 "	.77 "	8.95	19° 20′
1 1-8 "	.85 "	9.33	20° 40′

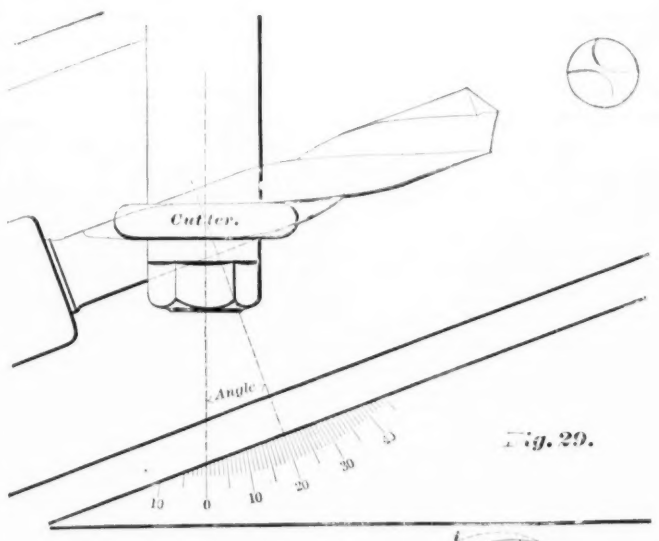


Fig. 29.

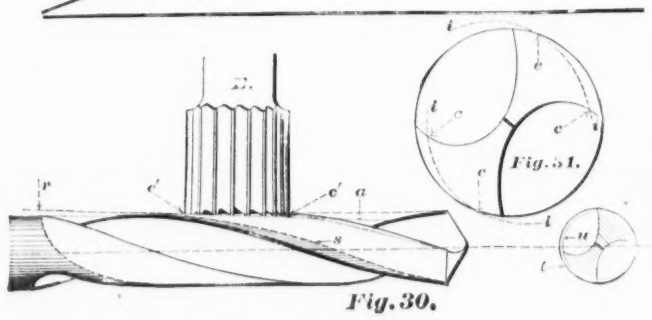


Fig. 30.

In the matter of cutters, it is certainly cheaper to buy them than attempt to make them. You can buy with the satisfaction of knowing that they are all right for the purpose intended; but as some prefer to make all the small tools used in the shop, a good idea of the cutter necessary to cut twist drills can be got from the drawing, Fig. 29. As in cutting the flute in taps, the drill, wherever possible, should be held in the chuck on the spiral head, and the outer end supported by the center rest, as in Fig. 32. The dead center cannot be used where the drill is held in the chuck, as it prevents the possibility of the spiral head being elevated, as is necessary to produce a groove that is deeper at the point than at the shank end of the drill. The groove is made in this manner to give strength to the drill. The amount required to elevate the head is only slight, and varies with every condition of the drill, as to length, size, and the purpose for which it is used, and can only be determined by experience. But the rule given by the Brown & Sharpe Manufacturing Co. is a safe one for the beginner, that is, to elevate the head for drills of 2″ and less in length $\frac{1}{2}°$, from 2″ to 5″ in length $\frac{3}{4}°$, and for other lengths 1°.

When the drills are either too large to pass through the hole in the spindle of the spiral head, or the cut is very heavy, and they are held between the centers, the head must be depressed to obtain the same shape of groove.

Fig. 29 shows the position of the drill and cutter in grooving drills. The center of the cutter should stand directly over the center of the drill, otherwise the shape of groove produced will not be of the shape shown in Fig. 31, which is a straight lip on the cutting side, or nearly so. The spiral for drills of different sizes and the angle for setting the bed of the machine for each are given below.

The manner of arranging the gears being different on different makes of machines, the gearing is left out of the table. In cutting a spiral, there is always more or less back lash that will cause the cutter to drag, and it is a good plan to lower the elevating slide or knee after each cut, while running back the slide or platen. To do this when the cutter is set to the proper depth, adjust the pointer on the index dial for the elevating screw to zero, turn the crank handle to the left half a revolution, and this will be sufficient to relieve it. Where there are a large number of flutes to cut, as in spiral mills or such tools, use the nuts on the stop screw at the back of the elevating screw, to prevent the possibility of a mistake by turning the handle too much and spoiling a cutter.

Fig. 32 shows the drill in position for cutting small sizes; it should be held down firmly when the cutter first commences to cut, as it is apt to catch and either break the cutter or bend the blank.

Fig. 30 represents the mode of backing off a twist drill for clearance. The amount of clearance given to a drill should be very slight for all ordinary work, and is another operation that can only be learned by experience, as the diameter of drill and the size of shank mill to be used for it cannot be laid down accurately. That is my experience with this part of the making of a drill. As will be seen by the illustration, the bed of the milling machine is thrown around at a slight angle, so that the back part of the cutter at *E* just touches the drill, leaving a margin on the cutting side of an amount varying with the size of drill from a $\frac{1}{64}''$ on a small drill up to $\frac{1}{8}''$ on a large one. This part of twist-drill making is to the beginner on a universal milling machine a difficult, or rather puzzling, job, and I would advise the novice to practice on something not very expensive at first, but with experience the job can be done perfectly and is not only a better job but can be done in less time than with a file, especially if the drill be a large one.

In making cutters for grooving twist drills the cut must run around the sides, as considerable of the cutting is done by the face of the cutter. The thickness of the cutter in decimals as given in the table determines the size of the circle on the outside of the cutter, this being in all cases a half circle. It is of course difficult to explain the operation of cutting twist drills, or any other kind of work that is intricate, to a person without having the machine to illustrate the way of doing it, but I have endeavored to use as plain language as possible and to lead the beginner on so that each part may be clearly shown as he goes on before beginning at another operation. Spiral cutting is the same for all purposes, whether for twist drills or spiral cutters, and the angle of the bed with the pitch or turn per inch on the piece being milled, together with the diameter, is all that is necessary to know, to enable the operator to do good work.

It is sometimes necessary to cut a spiral slot in a blank, as a periphery cam. This is done with a shank cutter that has a cutting face on the end. The knee of the machine in this case is raised so that the center of the spiral head and center is on a plane with the center of cutter spindle. All machines that have centers on the platen should have a mark on the slide on the base of the machine marked "center." This will save a great deal of time when an operation like the one under consideration is to be done. I would advise any one using a universal milling machine not having this mark to put one there at once, as some time when a job is wanted of this description in a great hurry it will pay to have it there.

In cutting a periphery cam, it is necessary to have a place to start the milling cutter.

Now, the chuck fitted to the live spindle comes into play, as with it a hole can be drilled in the blank while it is in position. It will be necessary to take several cuts with the shank cutter to get the required depth, and as the cutter will not run back in the groove it will have to be withdrawn. The index for the cross-slide is here used to determine the depth of the groove. Cams of a different shape from a simple spiral, such as a cam having a straight place at one or both ends running either parallel with the axis of the piece or cam, or running at a different angle, can be cut without any other fixture than the spiral head. Of course great care is necessary when changing from one angle to another not to have any bad spots or depressions in the cut. The end of Fig. 36 shows what can be done in this line by a skillful workman, and gives a fair idea of the many important uses to which the spiral head can be put.

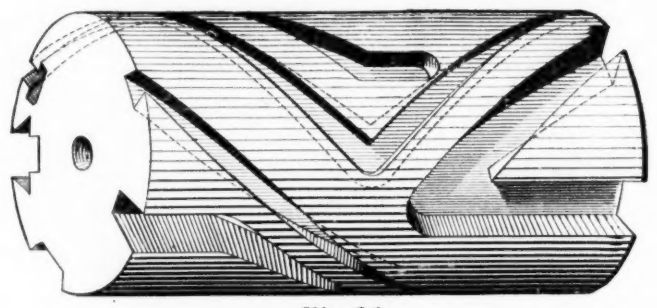


Fig. 36.

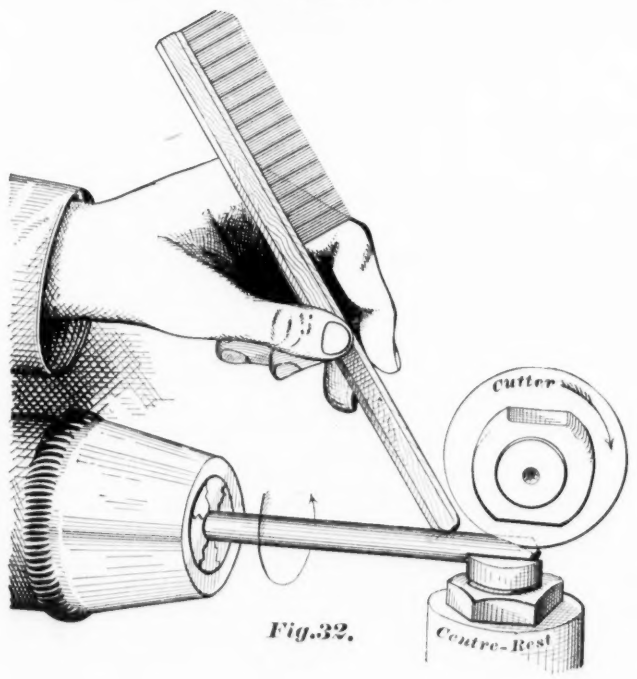


Fig. 32.

The steamship San Pablo, recently built by William Cramp & Sons, Philadelphia, Pa., for the Central Pacific Railroad Company, is lying in the dock connected with the works getting fitted out. The vessel will be ready to come round to New York in a few days, when she will load a cargo for China; and it is asserted that she will be the first American-built steamer to pass through the Suez Canal. In China the San Pablo will load tea for San Francisco. We observe that the engines of this steamer are controlled by the Westinghouse governor. An engineer who had been for several months on the State of California, a sister ship to this one, informed us that the Westinghouse governor on her engine effectually prevented racing in bad weather. Its action is so prompt that it will check the racing by the time the propeller makes a quarter turn at increased speed. The State of California is making a remarkably good record on the Pacific coast. She has made the run between Portland Bar and San Francisco, a distance of 540 nautical miles, in 35 hours and 40 minutes—a speed which has not been equaled out there.

Suppressing American Tin Making.

Some time ago American capitalists, interested in tin ores that have been discovered in this country, invited parties from Wales, who had experience in tin working, to come here and examine the ores, that they might judge whether or not the working of

our ores would be a financial success. The Welchmen reported favorably, and they made proposals to bring Welch workmen over here to engage in making tin plate from our ores. The South Wales Workmen's Union, hearing of this, called a meeting for the purpose of discussing the question of allowing their members to come to America, to engage in the tin-plate business. This meeting took strong grounds against their members coming here for such a purpose, and now the Workmen's Union consider that they have suppressed what might be a rival industry. This is not the first time that wordy resolutions have been resorted to with the view of obstructing the inevitable course of trade, but they never succeeded in braking the wheels of progress to a serious extent.

Locomotive Engine Running—Valve Motion.

BY ANGUS SINCLAIR.

OPERATION OF THE STEAM IN THE CYLINDERS.

As the work performed by a steam engine is in direct proportion to the pressure exerted by the steam on the side of the piston which is pulling or pushing on the crank-pin, it is important that the steam should press only on one side of the piston at once. Hence, good engines have the valves operated so that by the time a stroke is completed the steam, which was pushing the piston, shall escape, and not obstruct the piston during the return stroke, and so neutralize the steam pressing upon the other side. When an engine is working properly, the steam is admitted alternately to each side of the piston, and its work is done against a pressure on the other side not much higher than that of the atmosphere.

BACK PRESSURE IN THE CYLINDERS.

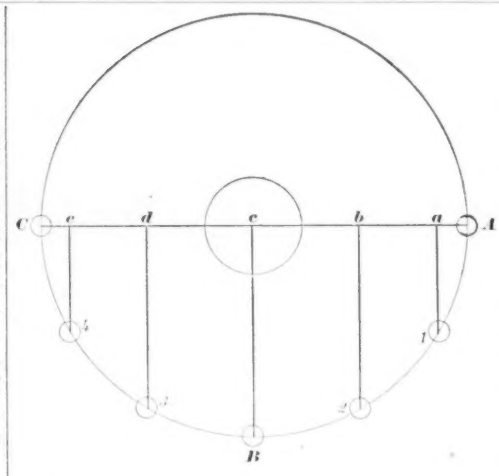
When, from any cause, the steam is not permitted to escape promptly and freely from the cylinder at the end of the piston stroke, a pressure higher than that of the atmosphere remains in the cylinder, obstructing the piston during the return stroke, and causing what is known as back pressure. There is seldom trouble for want of sufficient opening to admit steam to the cylinders, for the pressure is so great that the steam rushes in through a very limited space; but when the steam has expanded two or three times, its pressure is comparatively weak, and needs a wide opening to get out in the short time allowed. This is the reason why the exhaust port is made larger than the admission ports. Nearly all engines with short ports suffer more or less from back pressure, but the most fruitful cause of loss of power through this source is the use of contracted exhaust nozzles. Were it not for the necessity of making a strong artificial draft in the smoke-stack, so that an intense heat shall be created in the fire-box, quite a saving of power, now lost by back pressure, would be effected by having the exhaust opening as large as the exhaust pipe. This not being practicable with locomotives, engineers should endeavor to have their nozzles as large as possible consistent with steam-making.

Engines with very limited eccentric throw will often cause back pressure when hooked up, through the valve not opening the port wide enough for free exhaust.

Locomotives suffering from excessive back pressure are nearly always logy. The engine cannot be urged into more than moderate speed under any circumstances, and all work is done at the expense of lavish waste of fuel, for a serious percentage of the steam pressure on the right side of the piston is lost by pressure on the wrong side. It is like the useless labor a man has to do turning a grindstone with one crank, while a boy is holding back on the other side. The weight of obstruction done by the boy must be subtracted from the power exerted by the man to find the net useful energy exerted in turning the grindstone. In the same way, every pound of back pressure on a piston takes away a pound of useful work done by the steam on the other side.

EFFECT OF TOO MUCH INSIDE LAP.

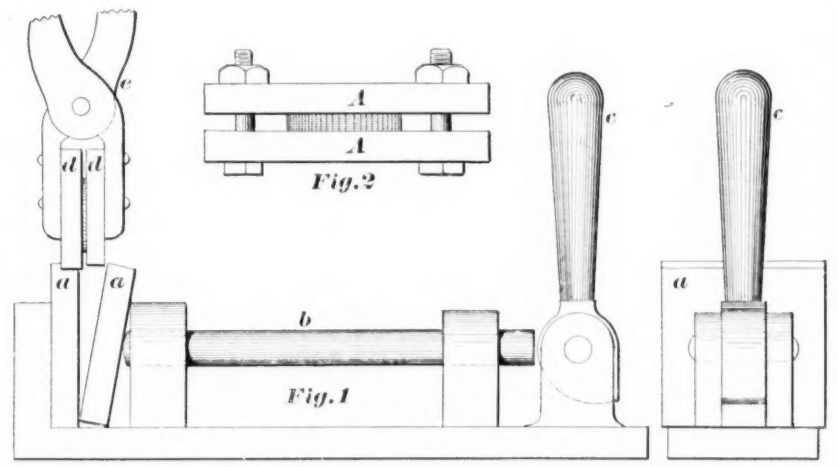
Engines that have much inside lap to the



valves are likely to suffer from back pressure when high speed is attempted. The inside lap delays the release of the steam, and where the piston's velocity is high the steam does not escape from the cylinder in time to prevent back pressure.

COMPRESSION.

The necessity which requires lap to be put on a slide valve to produce an early cut-off, in its turn causes compression, by the valve passing over the steam port, and closing it entirely for a limited period towards the end of the return stroke. As the cylinder contains some steam which did not pass out while the exhaust port was open, this is now squeezed into a dimininishing space by the advancing piston. In cases where too much steam was left in the cylinders through contracted nozzles or other causes, or where through mistaken designing of the valve motion the port is closed during a protracted period, the steam in the cylinder gets compressed above boiler tension, and loss of useful effect is the result. Under proper limits,



TEMPERING THIN CUTTERS.

the closing of the port before the end of the stroke, and the consequent compression of the steam remaining in the cylinder, has a useful effect on the working of the engine by providing an elastic cushion, which absorbs the momentum of the piston and its connections, leading the crank smoothly over the center. Where it can be so arranged, the amount of compression desirable for any engine is the degree that along with the lead will raise the pressure of the cylinder up to that of the boiler at the beginning of he stroke. When this can be regulated, the compression performs desirable service by cushioning the working parts, thereby preventing pounding, and by filling up the clearance space and steam passages, by that means saving live steam. Compression probably does some economical service by reheating the cylinder, which has a tendency to get cooled down during the period of release, and by re-evaporating the water, which forms by condensation of steam in the cool cylinder.

Engines that are running fast require more cushioning than those that run slow, or at moderate speeds. The link motion, by its peculiarity of hastening compression when the links are hooked up, tends to make compression a useful service in fast running.

DEFINITION OF AN ECCENTRIC.

The reciprocating motion which causes the valves to open and close the steam ports at the proper periods is, with most locomotives, imparted from eccentrics fastened upon the driving axle. An eccentric is a circular plate or disk, which is secured to the axle in such a position that it will turn round on an axis which is not in the center of the disk. The distance from the center of the disk to the point round which it revolves is called its eccentricity, and is half the throw of the eccentric. Thus, if the throw of an eccentric requires to be 5½ inches, the distance between the center of the driving axle and the center of the eccentric will be 2¾ inches. The movement of an eccentric is the same as that of a crank of the same stroke, and the eccentric is preferred merely because it is more convenient for the purposes to which it is applied than a crank would be.

EARLY APPLICATION OF THE ECCENTRIC.

On the early forms of locomotives a single eccentric was used to operate the valve for forward and back motion. The eccentric was made with a half-circular slot, on which it could be turned to the position needed for forward or back motion. It was held in the required position by a stop-stud fastened on the axle. Several forms of movable eccentrics were invented, and received considerable application during the first decade of railroad operating, but the best of them provided an extremely defective reversing motion. The first engineer to apply two fixed eccentrics as a reversible gear was William T. James, of New York, who made a steam carriage in 1829, and worked the engine with four eccentrics—two for each side. The eccentrics were connected with a link, but the merits of that form of connection were not then recognized here, for it was not applied to locomotives till it became popular in England, and was re-introduced to this country by Rogers. The advantage of the double fixed-eccentrics seemed, however, to be recognized from the time James used them, for the plan was adopted by our first locomotive builders. The first locomotive built by Long, who started in 1833 what was afterwards known as the Norris Locomotive Works, Philadelphia, had four fixed eccentrics.

RELATIVE MOTION OF PISTON AND CRANK, SLIDE VALVE AND ECCENTRICS.

When a locomotive is running, the wheels turn with something near a uniform speed, but any part which receives a reciprocating motion from a crank or eccentric travels at an irregular velocity. Fig. 1 shows the relative motion of the crank pin and piston during a half revolution. The points in the path of the crank pin marked *A*, 1, 2, *B*, 3, 4, *C*, are at equal distances apart. The vertical lines run from them to the points *a*, *b*, *c*, *d*, *e*, represent the position of the piston in relation to the position of the crank pin. That is, while the crank pin traverses the half circle, *A B C*, to make a half revolution, the piston, guided by the cross head, travels a distance within the cylinder equal to the straight line *A C*. The crank pin travels at nearly uniform speed during the whole of its revolution, but the piston travels with an irregular motion. Thus, while the crank pin travels from *A* to 1, the piston travels a distance equal to the space between *A* and *a*. By the space between the lines it will be seen that the piston travels slowly at the beginning of the stroke, gets faster as it moves along, reaches its highest velocity about half stroke, then slows down towards the end till it stops and is ready for the return stroke.

ATTEMPTS TO ABOLISH THE CRANK.

Certain mechanics and inventors have been terribly harassed over this irregular motion of the piston, and numerous devices have been produced for the purpose of securing a uniform motion to the power transmitted. These inventions have usually taken the shape of rotary engines. Probably the fault these people find with the reciprocating engine is one of its greatest merits, for the piston stopping at the end of each stroke permits an element of time for the steam to get in and out of the cylinder.

VALVE MOVEMENT.

The valve travels in a manner similar to the piston, although its stroke is much shorter, and its slow movement is towards the limit of travel. The small circle in the figure shows the orbit of the eccentric's center, and the valve travel is equal to the rectilinear line across the circle. If the valve opened the steam ports at the outside of its travel, the slow movement at that point would be an objection, since the operation of opening would be slow, but the valve opens the ports towards the middle of its travel, when its velocity is greatest, and the nearer to the mid travel the act of opening is done, the more promptly it will be performed. This has a good deal to do with making an engine "smart" in getting away from a station.

LETTERS FROM PRACTICAL MEN.

Tempering Thin Cutters.

Editor American Machinist:

I send you with this a simple sketch of a device I have used in tempering saws and cutters which are too thin to grind, such as fine comb and brush saws. Place the cutter in a pair of tongs, with jaws, *d d*, large enough to cover the cutter and heat the whole to the proper color, and, holding as shown, drop the cutter between *a a* (which are of steel and must be well oiled); at the same time drop the handle, *c*, which will press *a a* together, cooling and hardening the cutter. To draw, I bolt as many cutters as I have between pieces of polished steel, *A A*, Fig. 2, and heat over a clean fire to the required color. They always come out very true, and it is quickly done.

Can some one give us some ideas on tempering large pieces of steel, such as rolls, dies, etc.? E. F.

Cleaning Out Boilers.

Editor American Machinist:

If "Engineer" will try about a quart of coal oil and about three pounds of bi-carbonate of soda in his boiler, I am sure he will get satisfactory results. When I wash out my boiler, I put in about the above amount of soda before I put in the mud plugs, and the coal oil about two or three days before I wash out, and also a quart when I put in the soda. I never blow off—always run the water off just warm, which leaves all the mud and dirt at the bottom of the boiler. This is then easily washed out with a hose. I have also found japonica a capital thing to prevent scale (you can get it at a drug store). If your pump is connected direct with the city supply, you will have to put from 1½ to 2 pounds in when you wash out; but if you take water from a tub or barrel, put a piece about the size of your fist in every morning. Don't be alarmed at the color, which is very dark. It is a first-class purge.

A. B. B.

Effect of Inside Clearance of Slide Valves.

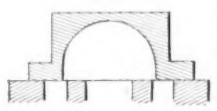
Editor American Machinist:

In Mr. Sinclair's article on locomotive engine running, appearing in your issue of February 23, I note the following:

"At a certain point of the stroke, inside clearance leaves both ends of the cylinder open to the exhaust, so there must be some

live steam lost by escaping through the opening."

This is a popular fallacy which needs correction. A valve with inside clearance *can* be drawn which will blow through, but the general statement is erroneous, and valves of practicable proportions do not do it. My position is this: A valve having its inside clearance less than its outside lap cannot, in consequence of its clearance, establish communication between steam chest and exhaust. The sketch will make this clear. Both steam ports are open to the exhaust, but *neither is open to the steam chest*, and if either be opened to the chest it will first be closed to the exhaust, if the clearance be less than the lap.



FRED. A. HALSEY.

[Mr. Sinclair admits that Mr. Halsey is right.]

Steam Engine Construction.

Editor American Machinist:

There is a point in the construction of horizontal stationary engines which is neglected, apparently. In the matter of securing an engine to its foundation, it seems to be thought that heavy bolts, and plenty of them, are all that is required.

Of course it is necessary that the shaft should be placed at right angles to the line of the cylinder, and level, as well. It is also desirable that the shaft should remain in this position after the engine is started; and to insure this, a solid foundation of masonry and heavy bolts is relied upon. But metals expand and contract with variations in temperature, and neither bolts nor foundation will prevent it in the case of a steam engine. The expansion of brick or stone per degree of heat is less than that of iron; and, furthermore, the foundation is beneath the cylinder, and little affected by heat from the steam.

Suppose an engine is set up where the mercury stands at 50 degrees: The work of building the engine has been done in a thorough manner, and it is placed in position with great care, the shaft being precisely at right angles with the line of the cylinder, and the nuts on the foundation bolts are set up hard. When the connections are made and everything in order, steam is turned on. The average temperature of the cylinder will now approach that of the steam, and the other parts will be affected according to their distance from the cylinder, until a point near the crank end is reached, beyond which the parts will have a temperature due to that of the room, which may be 90 degrees. The outboard bearing will not be affected injuriously by the increased temperature, there being no tendency to move it laterally. Now if the crank end does not move, and expansion takes place wholly in the direction of the cylinder, the effects may not be serious; but if expansion takes place in the direction of the main bearing, and in most cases it is probable that the main bearing yields to some extent, the effect is to throw the shaft out of its true position, and hot bearings and crank pin are the result. In any case, severe strains are produced, which are undesirable, to say the least.

The expansion of cast iron by heat is given by some authorities as one part in 162,000 for each degree. This may seem to be a small amount, but it is well known that, in the case of a steam engine, it is sufficient to affect the opening and closing of the ports, more or less, according to the design of the engine.

I know of a case where repairs were required on an engine of five ft. stroke, the bed being of the girder pattern. The bolts from cylinder to girder were removed as soon as steam was turned off. Some hours afterward, when the cylinder and girder had become cool, there was an opening of nearly $\frac{1}{8}$" between them, and it was found to be impossible to draw them together until the foundation bolts holding the cylinder were slacked up.

Not long ago, I saw a large engine, which had run but a short time, but long enough to have been in perfect order, and it was a fine piece of work to look at. The boxes were set up as closely as they would bear, but there was an unmistakable pounding, which showed the bearings were not in order. The trouble *may* have been caused by bad workmanship, but there is little doubt it was due to expansion of the bed, which forced the shaft out of its proper position.

In locomotive work, the frames are bolted to the saddle, and attached to the fire-box end of the boiler by clamps, which permits the fire-box end to slide upon the frames. Here, expansion is greater in degree, but not more certain.

The ill effects of expansion and contraction of the metal of which the engine is composed increase as the length of the shaft is decreased, the departure of the latter from right angles to the line of the cylinder being greater.

The shorter the bed, or frame, the less will be the trouble, of course, and small engines having a double crank, being self-contained, will not have the shaft disturbed.

In a very few engines, some provision for expansion of the bed and cylinder has been made, but they are the exception to the rule. There is no reason why the cylinder end cannot be secured to the foundation in such a manner that it can move in a line with the engine, and still be firmly held in other directions, and this with little, if any, additional expense. W. G. RICHARDS.

How to Clean a Boiler.

Editor American Machinist:

In answer to query of "Engineer," Nashville, Tenn., in issue of AMERICAN MACHINIST of February 9th, 1884, I herewith send full directions of the manner in which the four boilers are cleaned under my charge.

Let me first state the *facilities* we have for doing this work—for facilities are necessary in order to perform the work satisfactorily.

In the first place, the boilers are set in a "battery," each boiler having a furnace of its own, besides feed, blow-off, and steam pipe connections, so that any boiler can be cooled off for cleaning and repairs without inconvenience in working the adjoining boilers.

The side walls between boilers are 12" in thickness, with an air space of 4" between each adjoining wall.

The object of the air space is to prevent the heat passing from a furnace in use, to an adjoining one lying idle; this allows of the idle boiler being entered, without discomfort, for cleaning, repairs and inspection. A water tank is located in tower (elevation 44 feet to bottom of tank), from which the water supply is drawn for feeding and cleaning purposes.

The boilers are ordinarily fed with a hot water, direct-acting, steam pump. We also have a steam engine and pump combined, connected to water tank and boiler feed pipe *between* regular feed pump and boilers, so that should any derangement occur to the direct-acting feed pump, the supply to boilers could be maintained through the medium of the engine force pump. Should *both* pumps fail at the same time, the boilers, in this emergency, could be supplied direct from tank, by allowing the steam pressure to fall below the water pressure from tank. At the side of the boilers is a hydrant receiving its supply from water tank, with a section of $1\frac{1}{4}$" hose, with nozzle attached, sufficient in length to extend into any boiler three or four feet through man-hole opening. In rear of boilers, under the floor, is laid the sewer to which the surface and sediment blow-off pipes are attached. The feed pipe is connected to the sediment blow-off pipe outside the rear wall of boilers. In front of the boilers, under pavement, and about 12" distant from the fronts, is a branch pipe from sewer, with an opening directly in the center of each boiler. These openings are used only when boilers are being cleaned, and are for the purpose of admitting the foul wash water to sewer, which is conveyed thereto from front hand hole of boilers through the medium of a galvanized iron spout and the half of a cask with a $2\frac{1}{2}$ inch pipe nipple screwed into bottom of head, the cask being placed on the floor with the nipple inserted into sewer opening.

When a boiler needs cleaning, it is shut down from doing duty by closing all steam and water connections and removing fire from furnace, leaving the damper open, but all other openings to furnace closed. In this condition the boiler is allowed to remain *not less* than twelve hours. After this time has elapsed, should any steam pressure be indicated by steam gauge or try cocks, the surface or scum blow-off cock is opened to allow the steam to entirely escape. The man-head is then removed, sediment blown off; cock opened and all the water allowed to flow out of boiler. Now for the cleaning process. The soot is swept down and removed from front end of boiler and breeching; front hand-hole plate taken out and the galvanized iron spout adjusted to opening by means of two thumb clamps, placing a hand-hole plate gasket between end of spout and tube sheet to render the joint water-tight, so as not to injure the fire linings. The cask is then placed in position, when we are ready for water.

The hose connected to hydrant is carried to boiler and held by hand, injecting the water through the manhole upon the tubes and shell, until the upper tier of tubes is washed clean of mud, when the operator enters the boiler with the hose and thoroughly washes down to the boiler bottom all loose scale and sediment from every part of the boiler. Water is plentifully used for this purpose.

When this washing is completed, a wooden hoe, as large as will pass through the hand-hole, is attached to one end of a section of $\frac{3}{8}$" gas pipe by lock nuts and washers. This pipe is long enough to reach the rear end of boiler from front, and is for the purpose of drawing all loose scale to the front end of the boiler, when it can be easily removed by hand. After removing the loose scale a stream of cold water is turned on from water tank through feed pipe, then with the hoe we agitate the sediment remaining on bottom of boiler as the water is passing through the boiler. This operation carries all mud and fine particles of scale entirely out of boiler into cask, where it is caught in a pan provided for the purpose, preventing it from being carried into sewer where it might cause an obstruction. This process is continued so long as the water can be soiled.

Of course all ordinary methods are used in order to dislodge scale at any time during the process of cleaning—but nothing during my experience with steam boilers will loosen scale as thoroughly and rapidly as by contraction, *i, e.*, the injection of cold water on the scale while the tubes and shell are *moderately* warm. In fact, this is the only way known to me of dislodging scale in parts of a boiler inaccessible with a light steel bar and hammer.

After the *internal* cleaning is completed, the boiler shell is swept and tubes *scraped* of ashes and soot, air spaces and grates cleaned of clinker, ashes removed from ash-pit and combustion chamber.

I also think it a *safe* plan to turn the safety valve on its seat, see that the weight on safety valve lever is properly adjusted, tallow the plug in blow-off cock and valve of check, externally paint, with oil or tar, the front and rear tube sheets to prevent corrosion; enter the boiler with a good light, and examine the stays and braces and all accessible parts of boiler, in order to discover weaknesses of any kind, should they exist.

Enter the boiler furnace, and with a light ball pene hammer test the shell for blisters and corrosion by lightly hammering the shell over its entire suface; also examine the seams and shell in the vicinity of the rivet holes for leakages and *flaws*.

If I find no repairs needed, a gallon of crude petroleum is scattered over the internal surface of shell and tubes, which assists in the scale loosening process; it also materially prevents corrosion.

About half an hour or so elapses before the boiler is filled, in order to allow the oil to be absorbed by the scale, which should be dry before the oil is applied, when the man-head is put on. The boiler is then ready for use.

This process of cleaning I have followed for nearly ten years on the same boilers, and think I can safely say that the boilers (in condition) will compare favorably with others in use for this length of time. Let other engineers send in descriptions of their way of doing this kind of work. E. MANSELL.

Coldwater, Mich.

Cleaning Burnt Oil from Finished Work.

Editor American Machinist:

Under heading "Questions and Answers," in number seven (7), date Feb. 16, G. C., Victory Mills, N. Y., asks how to clean a cylinder head and steam-chest cover of oil burned on. I have charge of engine and presses in *Gazette* office. I use strong lye water for all such purposes. The cylinder head of my engine is as clean and bright now as the day it left the shop. At one time the grease was burned on so hard, I could not scrape it off. I take about one bucket of water in an iron kettle, and add one box of concentrated lye; put in the article to be cleaned and let it remain over night, when the grease can be wiped off with a rag. Small articles when the grease is not too badly burned on may be cleaned in a shorter time. Parts that I could not put in the vessel, such as pipes, frames, &c., I cleaned by wrapping with rags wet with lye water. I cleaned the steam pipe with steam on and the engine running. Lye will remove paint also. J. L. LITTLE.

Monmouth, Ill.

Complaint About Publishing Safety-Valve Tests.

Editor American Machinist:

In your issue of Feb. 23rd, page 3, appears what seems to the general reader an official report of the doings of the U. S. Board of Supervising Inspectors, while in Boston recently, making tests of safety valves, for the purpose of comparing the merits of the various makes of spring valves with the U. S. Standard Ball and Lever Valves. That it was not an official report we infer, because it is incomplete, incorrect and unjust. It is incomplete because the record of two important official tests are omitted; incorrect and unjust because it includes a spurious schedule of the working of two alleged Crosby valves, and excludes the schedule of the genuine official test, by which the Crosby valves are to be judged. This spurious schedule (which contains several errors, and all of them of a detracting nature) is the record of two alleged Crosby valves, which were obtained from a source unknown to us; tested in our absence, without our knowledge and consent; manipulated by persons unacquainted with their mechanism, and unused to their operation and adjustment, while the privilege of manipulating his own valves was accorded to every other maker whose valves were tested. This is manifestly unjust, and we affirm that those same valves—in friendly and competent hands—would have shown most excellent results; moreover, we claim the right to be judged at our best—as others are in this contest—and, therefore, we repudiate the schedule referred to. We distinctly understood from the Board that no comparative report would be made public. Such information as you have undertaken to give—to be of any value—should be correct, as, otherwise, it would tend to injure the reputation of makers, and mislead the public interested in such important instruments as safety valves. At the official test of Crosby valves made by the Board at our works subsequently, they informed us that two of our valves had been tested at 55 Sudbury street, and showed us the result (saying that "it was very good"), and asked us if we would accept it as a part of our test, to which we objected, and understood that the Board concurred in our objection, and that their rating of Crosby valves would be based wholly upon the data which they obtained at our works, according to pre-arrangements mutually satisfactory.

The result of the tests made with our

valves will compare favorably with those of any other make, but we refrain from offering them for publication in deference to the repeatedly expressed intention of the Board *not to publish the comparative details*, but only the ratings deduced from them, and unless the Board intended to mislead us—which we do not believe—or have radically changed their mind and intention, we should think that the publication of their doings in this incomplete and defective manner should merit and receive their public censure. In view of the foregoing, we feel that your report has been injurious to us, and we respectfully ask that you will so far make amends as to give this a place in the columns of your next issue.

CROSBY STEAM GAGE AND VALVE CO.
Boston, Mass.

[In regard to the above complaint, we have to say:

1st. There was nothing whatever in our account of the valve tests, published in our February 23d issue, to lead the general reader to believe that it was an official report.

2d. What we published in that issue was a *correct* account of the tests made by the Board during the first two days. It was written by the representative of the AMERICAN MACHINIST, who was on the spot watching every test for those two days. He took his data as the tests progressed, and carefully compared them with the data recorded by Board making the tests.

3d. In our February 23d issue we published all the tests we had particulars of up to the time of going to press. We publish more of the tests this week, and will publish the remainder as soon as the verified particulars are ready.

4th. Neither the U. S. Board of Supervising Inspectors, nor any manufacturer of safety valves, has any responsibility whatever for the publication of the tests in the AMERICAN MACHINIST. We are responsible for what news we publish, and select such as seems to us desirable.

5th. As the U. S. Board has no more censorship over what news we publish than has the Shah of Persia, the expression in the above letter, that our publication of tests should "receive their public censure," is simply ridiculous.

6th. As to the complaint of the Crosby Steam Gage and Valve Company being unfairly treated by the Board in the selection of their valves for testing, we have nothing to offer. It is a matter between that company and the Board, to which we are not a party.]

The Indicator Diagram.

BY F. F. HEMENWAY.

DIAGRAMS FROM CONDENSING ENGINES.

So far as computing the horse power is concerned, it is immaterial whether the diagram is from a condensing or from a non-condensing engine, the determination of the distance apart of the upper and lower lines being all that is required in either case. But in a condensing engine it is of interest to measure separately the work done above and below the atmosphere, so as to determine how much of all the work done to credit the condenser with. The pair of diagrams represented in Fig. 6 will serve to illustrate this, besides being interesting in other respects. They are from both ends of a cylinder 27″x36″, at a piston speed of ninety feet per minute; cylinder completely steam-jacketed, including the ends. The clearance is .026 of the piston displacement. The approximate theoretical curve is drawn on one diagram from a point near release, and on the other from a point just after cut-off. The mean effective pressure of the right hand diagram is 44.94, and of the left hand 42.06 lbs., an average of 43.5 lbs. The diameter of the piston rod is 3.5 inches, and the mean net area of the piston 567.75 inches, so the horse power for each pound mean effective pressure is $\frac{567.75 \times 1 \times 90}{33{,}000} = 1.548$. The pressure exerted below the atmosphere is, by the right hand diagram, 10.76, and by the left, 11.82 lbs., an average of 11.29 lbs., nearly 26 per cent. of the total mean effective pressure exerted. The indicated horse power is 63.33, and by the process previously explained the water per horse power per hour accounted for by the indicator is 18.6 lbs.

Of the prominent features of these diagrams, the admission lines are good, as well as the steam lines and cut-off, all of which is, of course, easy to bring about at the slow piston speed. The expansion curves show a remarkable departure from the theoretical curves, which is not easily accounted for if the steam jackets perform their duty of preventing initial condensation. If, however, there was a good deal of initial condensation, the heat from the jackets may have re-evaporated the most of the water, and the increase of terminal pressure may have been due to this; or it may have been due in part to the evaporation of water that entered the cylinder *as water*, and in part to leakage of steam valves. Whatever it is due to, it represents a loss that may in part be seen by considering that the space *a*, on the right hand diagram, represents work that might under better conditions have been done by the steam that was present in the cylinder at the opening of the exhaust valves. Measuring this space, it amounts to an addition of seven pounds to the mean effective pressure, or a determinate loss of 15.5 per cent. As the terminal pressure is about 40 per cent. higher than it ought to be, it is not at all probable that such an amount of water entered with the steam, so that the most of the rise in pressure must be attributed to initial condensation and evaporation later in the stroke, and to leakage of steam valves.

In calculating the efficiency of a condensing engine, so far as the work done below the atmosphere is concerned, it is essential to know the vacuum in the condenser; for, as in a non-condensing engine the back pressure that should be accounted against the cylinder is the difference between the line of counter pressure and the atmospheric line, so in a condensing engine it is the difference between the line of counter pressure and an imaginary line representing the pressure maintained in the condenser. Calculated in this way, under the same conditions otherwise, the back pressure in a condensing engine will be materially greater than in a non-condensing engine. In this instance, the vacuum by gauge was 25 inches, in pounds, 12.27. As the average pressure below atmosphere is 11.29, a small fraction of a pound being lost by compression, the result in this respect is very good, indeed. This small amount of back pressure would have been reduced by about $\frac{1}{4}$ pound if the exhaust opening on the end represented by the left hand diagram had been a little earlier and more ample. Of course, at higher speeds the back pressure would, with the same valves and valve motion, have been increased; in fact, at high piston speed it is not practicable to make the exhaust openings so ample as to result in so little back pressure as shown here. Altogether, these diagrams are excellent ones below the atmospheric line; good ones above so far as admission lines, steam lines, and release are concerned; but decidedly poor ones so far as the expansion curve has to do with their quality.

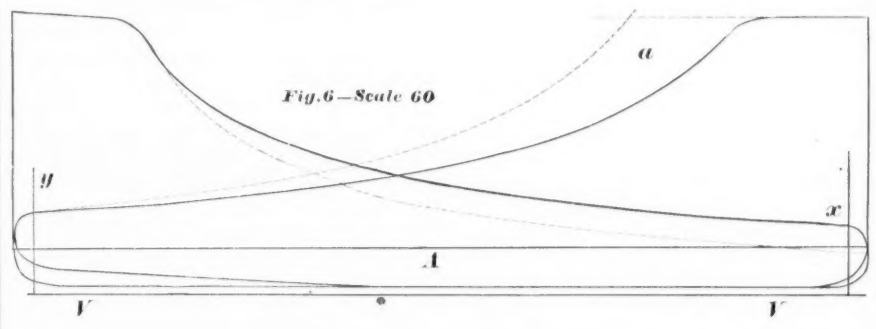


Fig. 6—Scale 60

The illustration, in this issue, of a modification of the Prony brake, and its application in testing a steam engine will be of value to those interested in such tests. There is great need of a ready and simple means of finding the actual power delivered to the shaft by a steam engine.

Sketch of the Life and Work of John M. Phillips.

On February 15, Mr. John M. Phillips, head of the engineering firm Hewes & Phillips, Newark, N. J., died very suddenly at his residence in that city. By his death Newark loses one of its most public spirited and enterprising citizens, and the country has lost a pioneer of its mechanical industries.

John M. Phillips was born on his father's farm in 1817, the land of which is now covered with fine residences, forming a suburb of Newark. When he became, by his intelligent industry, possessed of a liberal portion of the world's goods, he built a fine house on the site of his father's homestead. Hard work was the heritage of youth as well as of manhood when John was born, and the labors of the farm left him little opportunity to enjoy anything more than an ordinary school course of education. Like many other men who have made their mark in the world, he labored throughout the course of his life to acquire the knowledge denied to his youth, and he was very successful, for few of his contemporaries could rival his technical acquirements. In 1834 he went into the employ of Gould & Moore to learn cabinet making. Depression of trade in this business turned his attention to pattern making, which was becoming an important trade through the growth of machine work. Many men who have become our most celebrated engineers commenced their machine work as pattern makers, and Mr. Phillips' name stands among the list. He went to work for Seth Boyden, in Newark, and did the greater part of the pattern making for the famous locomotives "Orange" and "Essex" which Mr. Boyden built. These engines were the first locomotives ever built with an independent cut-off valve, and Mr. Phillips helped to plan the motion which afterwards was extensively applied to stationary engines.

From Newark Mr. Phillips went to the Novelty Works in New York City, which, under the direction of Horatio Allen, were then the most celebrated machine works in the country. Here he was employed as a foreman of pattern makers, and in this capacity gained a wide insight into machine construction. For a short time he worked in the West Point Foundry, still intent on widening his experience. In 1845, along with the late Joseph Hewes, he formed the firm of Hewes & Phillips, and commenced in a small shop in Vesey Street, New York, to make the Parkhurst wool burring machine. The young firm made several changes of location before finally settling down in Newark in 1851, but it retained the name which it bears to-day. Shortly after settling in Newark, Hewes & Phillips went into steam engine and machine tool building. His early connection with the Boyden cut-off inclined Mr. Phillips to favor that form of valve motion, and the firm went to building engines with the Boyden cut-off, many of them being at work to-day.

Machine tool making had made little progress in this country in 1851, and Hewes & Phillips entered into the business, helping by their good work to build up the high reputation which American machine tool makers now maintain all over the world. What was at the time considered an unparalleled feat in machine tool making, was performed by this firm during the war. A very urgent order was given to get out some heavy work connected with the first Monitor built for the Government, and there was no planer large enough to plane the plates. Hewes & Phillips undertook to build a planer for the emergency, and in three weeks after receiving the order, they finished a planer 72 inches square and 20 feet long. The work included making the drawings and every pattern used.

They executed a great deal of work for the Government during the war, the turret of the first Monitor which destroyed the Merrimac being their heaviest job. They also built part of the engines for that craft, and they did considerable work in small arms. A company was raised in their shop for the war and equipped by the firm, a proceeding which gave great offence to the copper-head element, which threatened to destroy the works.

Much of the success of the firm was due to the vigorous personality of Mr. Phillips. He trained three of his sons to the business, who are worthy successors of their father.

Boiler Inspectors' Tests of Safety Valves.

THIRD DAY.

The tests of safety valves by the Board of Government Supervising Boiler Inspectors, part of which were published in our issue of February 23, were continued at Boston. These tests were entirely public, every one having an interest in safety valves being welcome to watch the experiments and take notes of the results. Several parties availed themselves of this privilege, and there seldom was a test made without rival makers or their agents watching what was done. The following are the results of the third day's tests:

RICHARDSON CONSOLIDATED VALVE.

3 inches diameter.

Raised at	Pounds closed at	Distance Raised.
25	23	.16″
25 incr'd to 30	23	.16″
35	33	.18″
35 incr'd to 40	33	.2″
45	43	.16″
45 incr'd to 50	43	.205″
50	47½	.17″
50 incr'd to 55	47½	.17″
60 " 70	57	.17″
70	67	.13″
70 inc'rd to 76	67	.14″
80	78	.15″
80 inc'rd to 85	78	.15″
90	87	.14″
90 inc'rd 95	87	.145″
100	95	.165″
160	156	.115″
170	165	.0975″

Nest of six 1½″ Richardson consolidated valves. Both boilers were connected to steam drum.

Raised at	Pounds closed at	Distance Raised.
60 inc'ed to 71	56	.24″

ASHTON VALVE.

3 inches diameter.

Raised at	Pounds closed at	Distance Raised.
35	33	.13″
35 inc'rd to 40	33	.17″
40	37	.15″
40 inc'rd to 45	36	.19″
46	41½	.1675″
46 inc'rd to 50	41	.2″
60	52	.1875″
100	97½	.115″

ASHTON STATIONARY 3-INCH VALVE.

Raised at	Pounds closed at	Distance Raised.
100	96	.11″
100	96	.1175″

ASHTON 4-INCH VALVE.

Raised at	Pounds closed at	Distance Raised.
100	97	.055″

The tests of the Ashton valves were made at the works of the company, 271 Franklin Street, Boston. In connection with these tests, some very interesting experiments were made to show the working of the Ashton noiseless blow back valve. The whole volume of steam escaping through the safety valves was conveyed into a tank of water; and, but for the leakage of the pipe connections, it would have been difficult to tell when the valve opened and closed.

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NEW YORK, MARCH 8, 1884.

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The Outlook for Mechanical Industries.

Considerable uneasiness was felt in January about business in the machine and tool industries for this year. Complaints of dullness were not loud, but they were by no means few. While wages and selling prices of goods were being reduced on every hand, extra activity in productive industries could not be expected. This month, however, has witnessed something of a reaction. The decline in prices of iron has been arrested, and greater stability is observable in most lines of manufactured goods. It is not as easy to effect wholesale reductions of wages as it was a month ago, either in cotton mills, silk mills or other mills and factories. Iron mills, foundries and shops that were idle have resumed operations, and the long strike of glass workers has been terminated by a compromise as to wages, and the factories are again at work. These changes have given employment to several thousand more workmen, who are earning and spending money, thus adding to the progress and prosperity of general business. The threatened "horizontal reduction" of the tariff does not cause half as much anxiety as its prime movers anticipated it would, for the reason that there is no probability of its being made a law by the present Congress. New manufacturing enterprises are therefore projected with reasonable confidence. In the South, especially, there are many new cotton mills, lumber mills, cotton seed oil mills, iron furnaces and shops of various kinds now building, or soon to be built. In the States noted for manufacturing there is a fair increase of new productive enterprises projected and under way. A number of large railroad shops are building, and must be equipped with tools. The earnings of some railroads were less in January this year than for the same month last year, but the great roads of the Northwest all show a good increase during that month. As far as now reported the increase in February is still greater.

Taken as a whole the outlook in the mechanical line is far from discouraging.

The people of the State of New York are watching their Legislature now in session to see whether the members represent those who elected them, or a few prison contractors who have become wealthy at the expense and injury of free industry. By an immense majority the people said at the last election that they want the prison contract system abolished. The Legislature must act upon the question. The time for staving off legislation by appointing committees of inquiry to take evidence during the Summer has passed away.

Where There is Overproduction.

When the editor of "a great daily newspaper" is at a loss to account for industrial depression in certain occupations, and feels impelled to offer his readers some editorial explanation of the highly colored dispatches about dull business that appear in his news columns, he takes the convenient word "overproduction," and frantically rings the changes upon it in a column or two of leaded brevier. When his readers have carefully studied the lucid explanations, they usually know about as much concerning the cause of the depression as they did before reading it. When the whole production in any prominent industry is about the same in any given year as in the last preceding year, and the demand only about three-quarters as great, it is safe to say there has been an overproduction; but the cause needs some explanation. The word itself conveys but little meaning in such a case. The point to consider is why the people did not buy as much as before. If there has been a general overproduction of all kinds of articles, the people must have been too industrious, and need to take a rest. But this supposition is untenable. In some directions, however, there is a real, palpable overproduction, which ought to be checked. There is an overproduction of watered railroad stocks and inflated bonds, awaiting a greater production of confidence on the part of investors. There is an overproduction of humbug mining and manufacturing companies, with millions of dollars of capital on paper, representing little else besides cheek and chicanery. There is an overproduction of lawyers, politicians, speculators, and non-producers, and an underproduction of skilled mechanics and practical progressive farmers. There is an overproduction of officeholders, who travel on free railroad passes, and who grow wealthy while professing to serve the public on small salaries without other business or other "visible income." There is an overproduction of Italian opera, and an underproduction of cheap, wholesome public amusements. There is an overproduction of millionaires, monopolists, and tramps, and to dismiss the subject, we hazard the observation that there is an underproduction of independent daily and weekly newspapers that are willing to present these facts in their true light.

Power Humbugs.

We often hear expressions of surprise that people ever were benighted enough to believe in witchcraft and other supernatural deceptions of a past age. A little reflection as to the condition of intelligence in the world when such things were believed explains the prevailing credulity, for gross ignorance was then the rule, and ordinary intelligence the exception. But we cannot understand how in these days when most people have received some education, men are gulled with deceptions as senseless as anything claiming to be supernatural. Nearly all men of ordinary intelligence would feel indignant if they were charged with such ignorance of the laws of nature as to believe that power could be got out of nothing; yet many of them put large sums of money into the hands of swindlers, who promise to produce great returns by power obtained in that way. Mr. Keely has recently asked for more time to perfect his machine, a modest request which was readily granted, and the stock of the company continues to sell at some price. Meanwhile, other stock enterprises of the same nature are prospering. One of the most palpable frauds of this kind which is receiving the support of capital is a combustion company, which claims by a sleight-of-hand method to produce tremendous heat without ordinary expenditure of fuel. This concern is taking money out of the pockets of credulous capitalists by vague talk of raising carbonic acid to a high temperature, and making it act as a combustible. Of course, nature's laws which say that carbonic acid will suppress but will never support combustion, do not apply to a case of this kind.

It is astounding how men who are requested to put money into the development of an enterprise they do not understand, do not insist that it shall be examined by men competent to judge of its merits. Many inventions of merit have languished for years for want of capital to bring them out; yet any man with plausibility and sufficient cheek can get unlimited support to the veriest humbugs. They never tell their dupes that their money is going into the manufacture of a perpetual motion machine, or into the construction of a boiler that will make heat out of nothing; but these pretensions are disguised under a mantle of meaningless words. We hate to see rogues getting enriched by the plunder obtained in this way, but we scarcely feel pity for the victims who allow themselves to be defrauded by such transparent swindlers.

Boiler Setting.

Either it makes but little difference how the brick setting of a boiler is built up, or a majority of the boilers set in this way must be extravagant in the use of fuel. In but few things is there so complete a lack of uniformity as in boiler setting. Any mason is considered competent to set a boiler, not on plans carefully prepared by a competent and experienced engineer, but on plans of his own, usually evolved from a consideration of the material at hand. If the difference in practice in this respect could all be traced to the fact that this work is usually done by those who make no pretensions to an understanding of the laws of combustion, it would have no particular significance beyond showing that men are extravagantly careless in such matters, but there is apparently almost as great diversity of opinion on this subject amongst engineers as there is in the practice of those who claim only the ability to build up brick-work. For instance, we are told the exact proportionate area of opening over bridge wall; also that better results will obtain by removing the bridge wall. In the matter of combustion chamber, behind the bridge wall, one engineer will define its dimensions and another deny its utility. The run from the bridge wall to the back end is by some made of definite proportions, and by others as large as convenient; and the distance from the grate bars to shell, for the same sized boiler, will be found to vary all the way from 16 to 42 inches. Air spaces between the walls are approved and condemned, and in one instance the brick-work is built against the shell and in another studiously separated by iron plates.

If these differences were found only in connection with the use of different varieties of fuel, they might be explainable, but the puzzling part of it is that they are found where all conditions, including the quality of fuel, are the same. The whole subject of boiler setting, so far as economy in the use of fuel—and in many respects safety—is concerned, is one on which more light is needed. This light might be furnished if the effect of making changes was carefully noted, and the information contributed for the benefit of others; that is, the efficiency both before and after the changes. Quite as much could be learned from failure as from success. If there are definite proportions that ought to be preserved, what they are should be more generally known. The careful comparison of results would probably help to account for some of the wide differences in the evaporative efficiency of boilers, and in time lead to the establishment of a few simple principles of universal application.

Literary Notes.

THE AIR WE BREATHE, AND VENTILATION. By Henry A. Mott, Jr., Ph. D., etc. John Wiley & Sons, 15 Astor Place, New York. $1.

This little book gives a great deal of useful information on subjects in which most people are interested. The subjects are treated in a scientific manner, yet they are not loaded down with technicalities to be beyond the ordinary comprehension.

NOTES IN MECHANICAL ENGINEERING. Compiled Principally for the Use of Students Attending the Lectures on this Subject at the City of London College. By Henry Adams, M. E., etc. E. & F. N. Spon, 35 Murray Street, New York. $1.

Of late years there has been a vigorous agitation going on in Britain for the advancement of technical education, and the subject-matter of this book is compiled from lectures delivered before the students drawn to the City of London College, to receive instruction in the principles of mechanical engineering. A striking feature about the book is its exact condensation. It treats of a wide field of mechanical engineering, but it reads as if the author carefully avoided using a superfluous word. The notes are such data as would be likely to fill the pages of a practical mechanical engineer's note-book, who kept his matter specially well arranged.

The *Stevens Indicator* is the title of a magazine started by the students of the Stevens Institute of Technology, Hoboken, N. J., to be published monthly during the college year. It is artistically got out, is carefully edited, and excellently printed. The greater part of the pages is devoted to the discussion of matters connected with the school, and will prove interesting reading to the students and their friends.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(96) Q. R ——. asks: Will you tell me the names of some of the industrial schools that have iron-working shops connected with them? *A.*—Worcester Free Institute of Industrial Science, Worcester, Mass.; Stevens Institute of Technology, Hoboken, N. J.; Cornell University, Ithaca, N. Y.; Washington University, St. Louis, Mo; Massachusetts University of Technology, Boston, Mass., and others.

(97) A. L. M., Wilmington, Del., writes: I have lately put up what I call a pair of "idlers," that is, pulleys for changing the direction of a belt, so that the shafts will run at right angles. My partner says the correct name for these pulleys is carriers. Which is right? *A.*—Such pulleys are sometimes called by both these names, but perhaps more generally and correctly guide pulleys.

(98) C. A. L., Phœnix, Pa., asks: Is the pressure in the boiler and against the piston of an engine while in motion the same? *A.*—No; the pressure is always less against the piston than it is in the boiler. If a throttling engine, the governor reduces the pressure to control the speed. If a cut-off engine, the pressure may at the beginning of the stroke be nearly, but not quite, equal to that in the boiler.

(99) A. K., Millsville, Pa., asks: What is a second motion engine? Would an engine with a second shaft be a second motion, and one with a third shaft be a third motion engine? *A.*—We do not think it is customary to designate engines in this way. A geared locomotive, in which the driving wheels are on a second shaft, driven by gearing from the crank shaft, may sometimes be called a second-motion engine.

(100) H. K., Galveston, Texas, asks: 1. Is there any method known by which the lime in sea-water can be made harmless to boilers? *A.*—Only by blowing off the lime, or getting rid of it in some way. 2. Is there any particular construction of boiler in which sea-water can be used without harm? *A.*—No. Boilers in which sea-water is used should be of simple construction, so arranged as to be accessible for cleaning.

(101) J., Roanoke, Va., asks: 1. Can the water from heating pipes be returned to a small upright boiler, used exclusively for heating, by a pipe entering at the bottom of the boiler? *A.*—Yes; if the heating pipes are above the boiler. 2 Is a bent pipe essential for a steam gauge, or will right angle connections do as well? *A.*—Right-angle bends will do as well, only you must arrange the pipe so as to form a siphon, the same as with the bent pipe.

(102) P. B., New Haven, Conn., asks: 1. he governor and eccentric of the high-speed mill engine, illustrated in the AMERICAN MACHINIST of February 4, 1882, patented? *A*—The governor is patented, and we believe the arrangement and plan of attaching to the eccentric. 2. Is not Todhunter wrong in stating that it is "the minute protuberances of the surface" that prevents a belt from slipping? *A.*—We believe he is substantially correct.

(103) A. N. T., New Orleans, La., asks: 1. What is the proper way to build a bridge wall, straight across on the top, or circular? *A.*—It is generally considered that it makes little or no difference which way it is built. 2. Is it generally considered better to fill in the space back of the bridge wall; and, if so, why? *A.*—It is generally customary to fill up this space, leaving ample room for the gases, the principal reason for which is that it leaves less room at the sides for loss of heat through the brick work.

(104) H. W—— asks: 1. Will a boy going to the machinist trade get an opportunity to learn it, and a chance to work his way up, or will he be kept upon one thing? *A.* It depends almost entirely upon the boy. All shop men and proprietors are always interested in helping a boy who is disposed to help himself to the best of his ability, and such boys seldom have occasion to complain of lack of opportunities to learn in the shop. 2. Where can a young man learn steam engineering, and what wages does a steam engineer get? *A.*—We suppose you refer to learning to run and take care of a steam engine and boiler. Unfortunately, we think, there is no process of learning this business. Engineers get all the way from $1.50 to $3.50 per day.

(105) G. T., Wichita, Kan., writes: We use a surface condenser for the sake of getting pure water, but are troubled with the grease from the cylinder. We use the best mineral oil in the cylinder, still when the boilers get greasy the sheets over the fire are liable to bag. Is there any way to prevent the oil from entering the boiler, or to get rid of it after it has entered? *A.*—It is very difficult to keep the oil out of the boilers. It would perhaps be possible to keep the greater part of it out, by allowing the water to stand for some time in a reservoir before pumping into the boilers, but the heat in the water would then be lost. About all that can be done is to use no more oil in the cylinder than is absolutely necessary, and then use the surface blow, to blow it out of the boiler. We think it would be a good plan to try using soda in the boiler, putting it in a day before cleaning boilers. This would have to be tried carefully, as it may cause foaming, so that it cannot be used at all.

(106) A. W., Providence, R. I., writes: I want to add steam lap to a valve. Is it necessary to increase the travel of the valve, or the throw of eccentric? In other words, if you add steam lap to a valve, must you, in all cases, increase the travel? One author says the throw of the eccentric should be the sum of the width of both ports, with lap at both ends added. Does that rule hold good in all cases of plain slide valves? *A.*—The rule is not necessarily right with reference to any valve. Whether the valve travel should be increased depends upon many circumstances, such as the dimensions of ports, speed of engine, present travel of valve, &c. It is generally considered that the exhaust opening should be greater than that for admission, and it is the practice of many builders of slide-valve engines to proportion the lap and travel, so that the port will be only partly, say ¾ or ⅞ opened for admission, but fully opened for exhaust. If, with the present lap, the port is fully opened for admission, you can, if the port opening is ample, add lap so that it will not be quite opened, using the same travel as at present.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gears—G. B Grant, 3 Alden st., Boston; water motors

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Patterns & Models, G. D. Lambert, New Haven. Ct.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c J. B. Roney, Lynn, Mass.

F. VanWinkle, Mech. Engin'r, 22 Cortlandt St., N. Y.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Spanish translations of catalogues, circulars, &c. J. M. Da Rosa, 260 East 3d St., Cincinnati, O.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells, & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 144 LaSalle street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large; prices low. Frasse & Co., 62 Chatham St., N. Y.

H. O. Reinhardt, M. E., Mem. Am. Soc. Mining Eng., Chihuahua, Mex., invites correspondence of man'f'rs of machinery desiring to introduce same in Mexico.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

"Painting and Painters' Materials."

The best book for all who paint, deal in paint, or have painting done. $2 25. For sale by "The Railroad Gazette," 73 Broadway, New York.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, 1882, and 1883, for sale at $3 50 per volume, express charges to be paid by purchaser. We will pay 50 cents per copy, to any of our readers who will forward us the first two numbers of 1881, or Nos. 1 and 3 of 1882. They must be clean and in good order. AMERICAN MACHINIST Pub. Co., 96 Fulton Street, New York.

Any of our readers who have complete files of Volumes I. and II. in good condition, bound or unbound, can probably find a purchaser by addressing us, and stating the lowest price they will accept. AMERICAN MACHINIST PUBLISHING COMPANY, 96 Fulton street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, containing nearly 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with additional illustrations, many of them humorous and all effective; over 50 in all. Just the thing for a holiday or birthday gift. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

Patent "Common Sense" Binder for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address, in the United States, by mail for one dollar. To Canada and foreign countries 75c., the purchaser to pay custom-house duties and express charges. American Machinist Publishing Co., 96 Fulton street, New York.

MANUFACTURES

Dennison, Texas, wants a large machine shop.

Blissfield, Mich., is working to get an iron foundry.

Smith, Gifford & Co. will erect a $100,000 sugar refinery at Nashville, Tenn.

Rockingham, N C., is having a new cotton mill, 320x60 feet, and two stories high.

A silk factory is talked of at Uxbridge, Mass., and several mills in town are offered.

The Anniston (Ala.) Cotton Factory propose to build another mill of 25,000 spindles.

Several capitalists are talking of establishing an immense ice factory at Corsicana, Texas.

The Woodstock Iron Company, of Anniston, Ala., will soon erect two additional coke furnaces.

Hay & Mellete, of Winamac, Ind., are looking for a site for a woolen factory in Tuscaloosa, Ala.

Sweet & Clark, of Troy, N. Y. propose to operate the now vacant malleable iron works in Akron, O.

The proposed reduction in wages of stove moulders, at St Louis, seems to have been abandoned.

Toronto capitalists are talking of erecting a farming implement manufactory, at Moncton, N. B.

The National Vehicle Company has been organized at Racine, Wis., to make wagons of different kinds.

S. H. Walker, Washington, D. C., will build a six-story brick factory on F street, between 22d and 23d streets.

The Racine Wagon and Carriage Company, of Racine, Wis., have increased their capital from $50,000 to $150,000.

Peter M. Wilson, 144 West 22d street, New York, will build a five-story factory, 41x46 feet, at 410 Bleecker street.

Work has been resumed in most of the iron and steel mills of Pittsburgh and the West that shut down for repairs.

A joint stock company has been organized in Durham, N. C., for the purpose of manufacturing woolen goods.

Howard Watch Company, Boston, are about to erect a four-story factory, 33x104 feet, on Clifton street, corner of Shirley.

Meirowitz & Altman, 372 East Houston street New York, will build a five-story furniture factory at that place, to cost $7,500.

The Matthews Cotton Mills Company, Selma, Ala., are putting in an Albro-Hindley screw elevator, built by Clem & Morse, Philadelphia.

Fergueson Brothers, cornice manufacturers, 200 Canal street, New York, will erect a five-story factory, 50x40 feet, at 542 West 40th street.

The Griffin (Ga.) Manufacturing Company has had its whole capital stock (about $85,000) subscribed and will go ahead and erect a cotton factory.

The Grinnell Wire Company, at Grinnell, Iowa, will soon start their new mill. The power is furnished by a Westinghouse automatic engine.

H. B. Scutt & Co., Joliet, Ill., are building a large shop, to manufacture a new tile-ditching machine that is said to make over a mile of drain tile a day.

The *Worcester* (Mass.) *Spy* says business is brightening in the local foundries, the basis of the iron industries, and the demand for scrap iron is improving.

All the machinery for the Newberry (S. C.) Cotton Mills has been contracted for, and the contractor expects to get the factory building under roof in March.

The N. O. and N. E. Railroad will build large machine shops at Meridian, Miss. Work has been commenced. About five hundred hands will be employed.

The property of the Brownsville Manufacturing Company, Brownsville, Tenn., has been sold to John Clinton, who proposes to organize a new company and rebuild the factory.

General Wilder has commenced the erection of a large machine shop on Boyce street, near the Wasson Car Works. It will be 50x150 feet, one-story brick.—*Chattanooga Tradesman.*

Columbia, Tenn., is to have a $175,000 cotton factory. The Manufacturers' and Immigration Association of that city have taken the matter in hand, and all the capital has been subscribed.

The Chattanooga (Tenn.) Foundry and Pipe Works will give employment to one hundred and fifty hands when they resume operations. The capacity of the works has been doubled, involving an expenditure of $18,000.

Pickin, of New York, is the contractor at the Albany penitentiary, in the shoe manufactory, and they turned out more shoes than all the rest of the shops in Albany put together. Last year they turned out one hundred thousand pairs of shoes.

Madison, Ind., has raised $88,000 of the necessary $105,000 required to secure the removal of the Eagle Cotton Mills from Pittsburgh to that place, and is making vigorous efforts to secure the remaining $17,000. The mills employ 350 people, and the weekly pay-roll amounts to $1,700.

There is nothing doing on new work in the Hinckley Locomotive Works, Boston. There are several old engines in the shop, belonging to the New York and New England Railroad, which are undergoing repairs, and that is all the work the company has on hand. Nearly all the machines are idle and the shops look deserted.

Dean Brothers, of Indianapolis, Ind., have recently furnished a complete set of water works for a large lumber company, at Eau Claire, Wis.; also, a large pump for the Clarksville (Tenn.) Water Works; also, a set of vertical pumping machinery for the Citico Furnace, Chattanooga, Tenn.; capacity, one million gallons per day.

Seymour & Whitlock, 43 Lawrence street, Newark, N. J., have rented a large building across the street from their present shop. In their present quarters they are very much hampered for want of room, and they intend using the new building for storage, so that they may be able to increase the machinery of their shop.

The Janney Car-Coupling Company, of Pittsburgh, Pa., has been incorporated. The capital stock is $100,000, divided into ten thousand shares of the par value of $10 each. William McConway holds 9,960 shares of stock, and George Rollings, W. P. Siebert, F. J. Rebbeck, and H. E. Bahoup, of Chicago, hold ten shares each.—*Railway Review.*

The Whittaker Engine and Skein Company, of Kenosha, Wis., report trade very good. They have in contemplation, in the early spring, the erection of additional buildings to their works, and will otherwise increase their facilities for manufacture. They also intend making a new departure in their business, and will commence the manufacture of machinists' lathes.—*Industrial World.*

Charles E. Lipe, Syracuse, N. Y., has recently filled orders for his heavy, plain milling machine, as illustrated in the AMERICAN MACHINIST of Nov. 3-1883, from B. W. Payne & Sons, Elmira, N. Y., and J. S. Graham & Co., Rochester, N. Y. The latter machine had a table six feet long, with four foot bearings, and was provided with a vertical spindle for cutting ⊥ slots in their cylinder knife-heads for planing machines, at the same time that the regular cutters operate on the surface.

We learn from the Troy *Standard* that the Albion Direct Process Iron and Steel Company has been incorporated, at Cohoes, N. Y., by Edward N. Page, Jones Ravenscraft, Cyrus M. Ward, John T. Cook, and John Bridgeman. The last-named individual is the inventor of the process. Capital is $250,000. It is intended to convert iron ore into finished iron or steel at one operation, without puddling. The ore will be secured near Whalesburg, on Lake Champlain, and there is some talk of locating the works there.

The Corliss Steam Engine Company, Providence, R. I., are building for the Atlantic Mills, of that city, a compound condensing engine, cylinders 24″ and 44″ diameter, stroke 6 feet, to run 45 revolutions per minute, a horse-power per hour, with the consumption of 1.7 lbs. of coal, being guaranteed. A spur wheel, 30 feet diameter, 24″ face, teeth finished by cutting, to be used with the engine, is also being made at these works. This wheel, as may be seen, will have a velocity at the pitch circle of about eight-tenths of a mile per minute.

T. New, 32 John street, New York, who has been in the roofing business for over thirty years, informs us that the demand for his prepared roofing has made it necessary to erect, during the past year, a large felt mill to supply the needed raw material. Some of the largest manufacturers in the country have adopted this roofing, and say it is the best adapted to their buildings of anything they have ever used. Mr. New sends without charge, to inquirers, a small sample and descriptive circular of it, that parties may see just what it is, how made, and what is thought of it by those who have used it.

The Chicago Tire and Spring Company consider their outlook for business is very encouraging; they are turning out about ten tons of springs daily, and they finish a tire for locomotive use every thirty seconds, which they are now doing during the complete circle of the day and night. This company have now about 4,000 tires in service, not one of which has broken or been turned off. The Chicago and Northwestern Railroad has some 200 of these tires in service, and they are giving unusually good results. Some of them have run over 100,000 miles, and are still considered good for more service without turning up.

The Star Tool Company, Providence, R. I., in addition to their well-known line of machine tools, are doing a good deal in the way of machines for special purposes. We recently noticed at their works two machines of this class, built for the Cleveland City Forge and Iron Company, to be used in the manufacture of turnbuckles. One of these machines is for drilling both ends of a turnbuckle at once, and the other for similarly tapping the holes—one man operating both machines. The turnbuckle is held in the center, between two heads in the case of the drilling machine, each head carrying a drill, which is automatically fed forward, the distance being controlled by a stop motion. In the tapping machine, after the taps have passed through the holes, the motion is automatically reversed, withdrawing the taps. The cutting off machine made by this company, for cutting up and centering stock from ¾″ to 5″ diameter, with their improved adjustments, automatic feed, and double-speed countershaft, is coming into very general use, as well as their improved boring machine. The building of these, with their special and general line of machine tools, is keeping them busy.

Machinists' Supplies and Iron.

New York, February 21, 1884.

The supply business continues substantially unchanged.

In Iron there is no especial change. The larger furnaces, having contracts ahead, are not inclined to sell at present prices; or, at least, are indifferent. No. 1 X Foundry is quoted at $20.50 to $21, with a few special brands selling a little higher; No. 2 X, $19.50 to $20; Grey Forge, $16.50 to $17, with slow sales.

Scotch pig is dull, and sales moderate. Coltness lacks buyers at $21.75, to arrive; Glengarnock, $22.50, at yard; Gartsherrie, $23; Summerlee, $21.50, to arrive; Eglinton, $20 to $20.50; Langloan, $22; Dalmellington, $20.75.

Copper sells slow, at—Lake, 14⅞c. other brands 14¼c. to 14⅜c.

Lead is quiet, but steady, with jobbing lots at 4.15c. to 4.20c.

Tin is held reasonably firm, at—Banca, 19¾c.; Straits and Malacca, 18⅝c. to 18¾c., with no prospects of immediate change.

✲WANTED✲

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

A mechanical draughtsman wants situation. Good references. Address E. D., Am. Machinist.

Responsible position wanted, by experienced mechanical engineer and draughtsman. Address Steam Engine, Am. Machinist.

A young man experienced in that line, wants situation to erect engines, or other machinery. Address Box 6, Am. Machinist.

First-class, experienced mechanical draughtsman desires situation. Address E. L. H., 215 Ohio street, Chicago, Ill.

Wanted—A salesman for a well-known automatic steam engine. Address—giving references, and stating age, experience, and familiarity with steam engineering—Box 15, Am. Machinist.

Wanted, situation—First-class machinist and die maker, well posted in ivory and composition button manufacturing; has valuable improvements in ivory machinery. A. B., 58 Genesee street, Auburn N. Y.

Wanted—A good second-hand planer; size, about 42″x42″x10 feet. Must be in good order and ready for immediate delivery. Send particulars, giving size, condition, maker, where it can be seen, with lowest net price, to Box 7, American Machinist.

Wanted—A first-class pattern maker, with experience in gearing, jobbing, and general machinery; able to make drawings, and look after other pattern makers. Address W., Box 11, Am. Machinist.

Foreman blacksmith wanted—In a large works, near New York. Must be familiar with machinery forgings, steam hammer, furnace work, &c. Address—giving age, experience, and references—"B. T. X.," office of American Machinist. New York.

Situation wanted, as foreman of a boiler shop. Have had 20 years' experience as foreman, and am conversant with marine stationary and locomotive work; author of recent articles on boiler making, published in the American Machinist. Address George Marshall, care American Machinist.

Wanted—A thorough, competent brass moulder, of experience and well acquainted with gas, steam, and water work, and of ability to oversee twenty to twenty-five men, to act as assistant, or (if desired) as foreman. Address P. O. box 1,358, New York, N. Y.

Wanted—A man capable of superintending construction of portable and stationary engines, boilers, and saw mills, and managing 200 employes. Middle-aged man preferred, and must be thoroughly competent and of sober habits. Location in Pennsylvania; position permanent, and pay liberal. Address Builder, Box 9, Am. Machinist.

Iron Hand Screws—4 in. 50c., 5 in. 75c., 6 in. $1. Strong and neat. E. R. Brown & Son, Windsor, Conn.

For sale, cheap—Second-handed Eureka steam hammers, Nos. 2 and 3; also, one steam engine, 11 by 18. All in good order. Moltz Brothers, Williamsport, Pa.

Machine and Tool Company, who have first-class tools, desire to meet parties who have special machinery or tools to build. Address Company, Box 8, care Am. Machinist.

FOR SALE—Harris Corliss Horizontal Condensing Double Engine, Cylinders 20 x 42 and 18 x 42. Wheel 16 feet diameter and 39 inch face. In good order, replaced by larger engine.

To be seen at Planet Mills, 372 President Street, Brooklyn, N. Y.

FOR SALE.

45′ Sellers & Co.—Column Drill,
6 Smaller Drills—new and second-hand,
24″, 26″, 32″ Planers,
Small Pratt & Whitney Shaper,
Eccentric Chuck, Standard Mandrels,
Planer Centers, &c.

A. G. BROOKS,
261 N. 3d St., Philadelphia, Pa.

STANDARD STEEL CASTING CO.
Thurlow, Penn.

STEEL CASTINGS

To Any Pattern or Weight.

Strength and Quality Equal to Steel Forgings.

B. BURBANK & CO.,
MINERS AND SHIPPERS OF
FLUOR SPAR,
Furnished in any quantity. EVANSVILLE, IND.

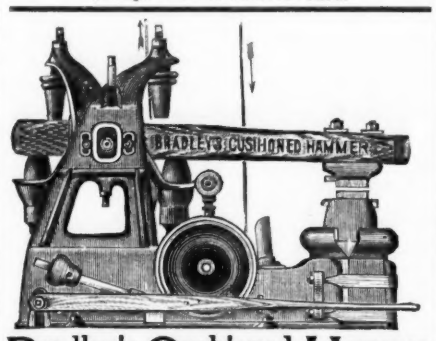
HILL, CLARKE & CO.

36 OLIVER STREET,
Boston, Mass.
BRANCH OFFICE, 800 N. 2nd STREET,
St. Louis Mo.

Have just issued new

CATALOGUE
—OF—
LIGHT MACHINERY & SMALL TOOLS.

Sent free to Manufacturers and Dealers on receipt of their business card.



Bradley's Cushioned Hammer
Stands to-day WITHOUT AN EQUAL.
OVER 800 IN USE.
BRADLEY & CO., Syracuse, N. Y.
ESTABLISHED IN 1832.

FOR SALE, ONE 9 FOOT BORING AND TURNING MILL, with two heads, built by Niles Works, Cincinnati, Ohio. In very good working condition. *Will be sold at a low figure.* We have contracted with the Niles Tool Works for a mill to swing 20 feet, and therefore offer the small tool for want of room. Address,
COLUMBUS MACHINE CO.,
Columbus, Ohio.

The *Baltimore Manufacturers' Record*, publishes every week, under the head of "Construction Department," a list of all new enterprises undertaken in the South, such as cotton and woolen mills, or factories of any kind to be established; old mills to be repaired or enlarged; public buildings, hotels, &c, to be erected; railroads to be constructed; mining enterprises to be inaugurated; furnaces to be started, &c., &c. The information thus furnished is new and reliable, and will be found valuable to contractors and mechanics, and to dealers in mill and railroad supplies, machinery, tools, building hardware, &c., who can correspond with the projectors of the enterprises (whose names are given), before they have bought their supplies.

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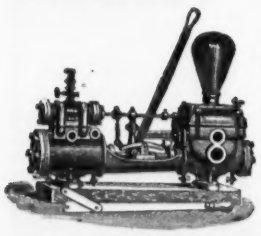

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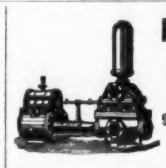

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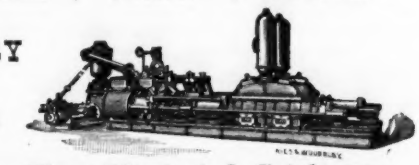

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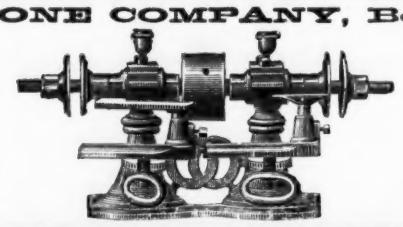

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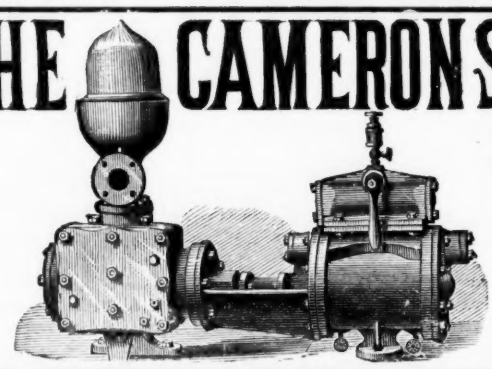

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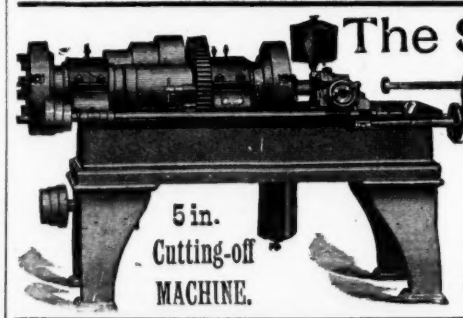

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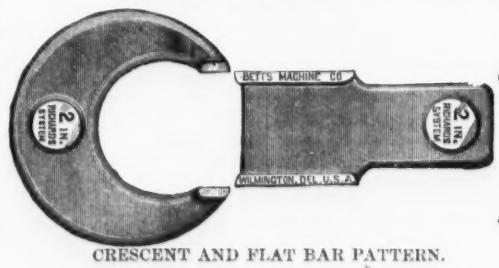

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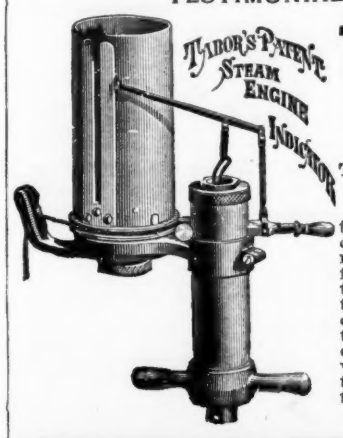

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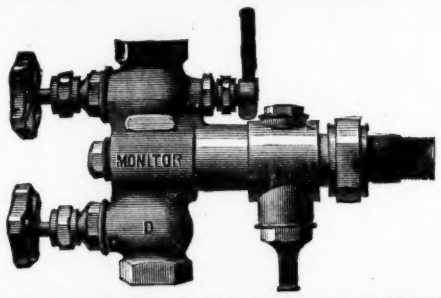

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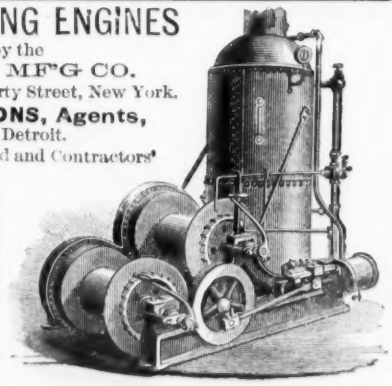

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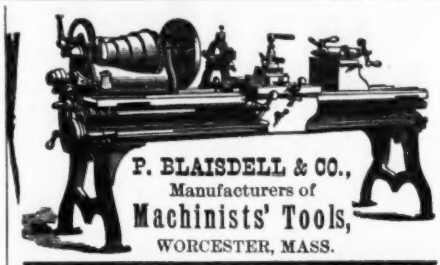

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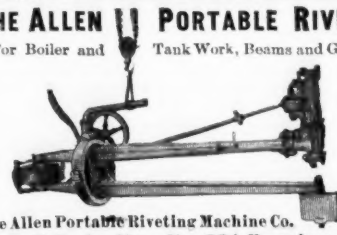

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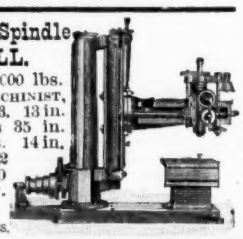

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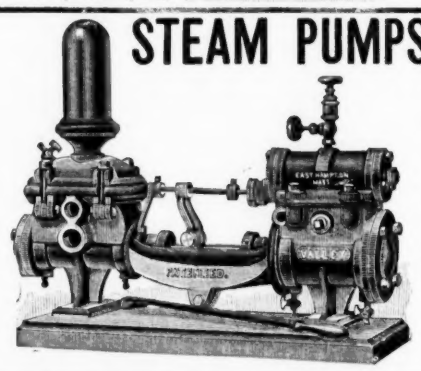

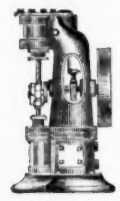

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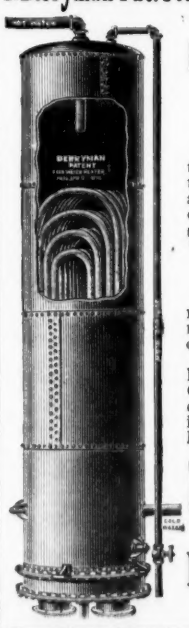

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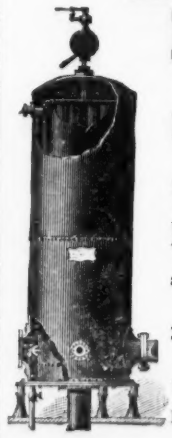

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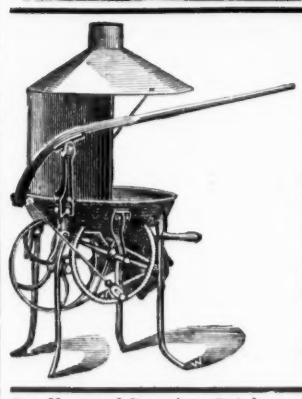

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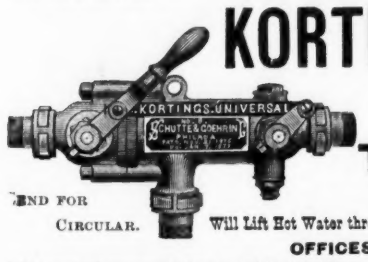

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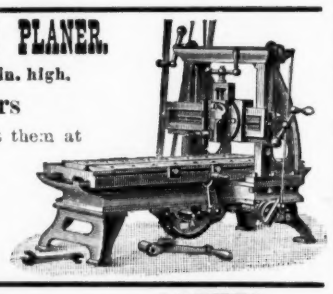

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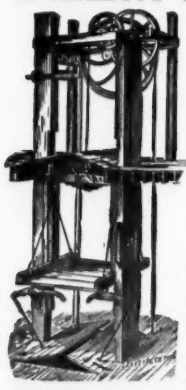

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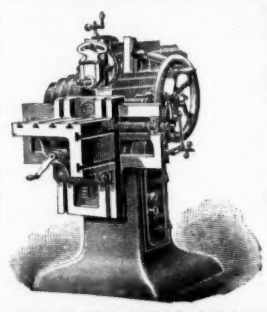

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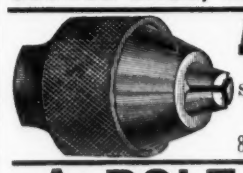

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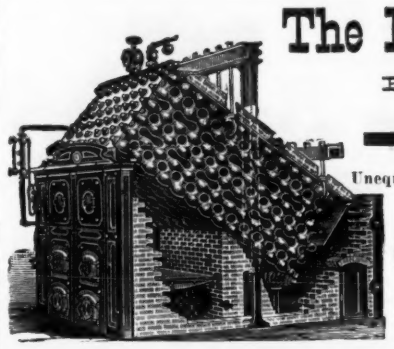

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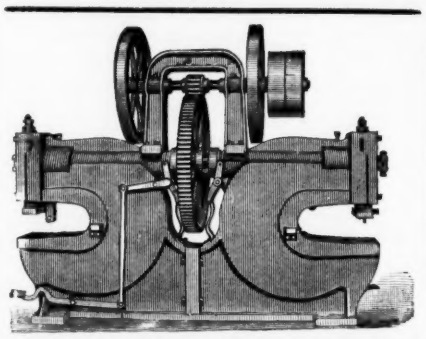

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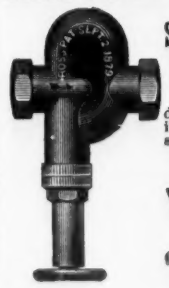

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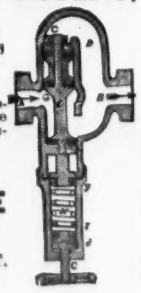

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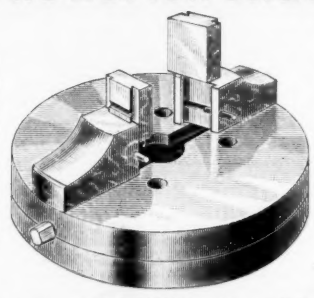

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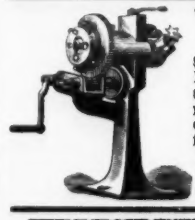

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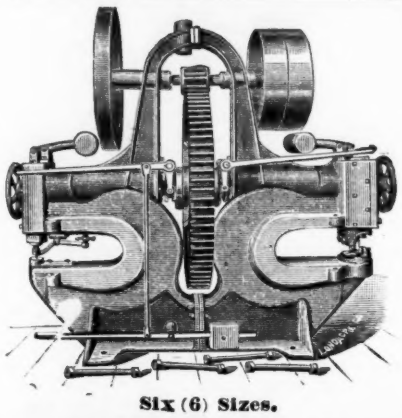

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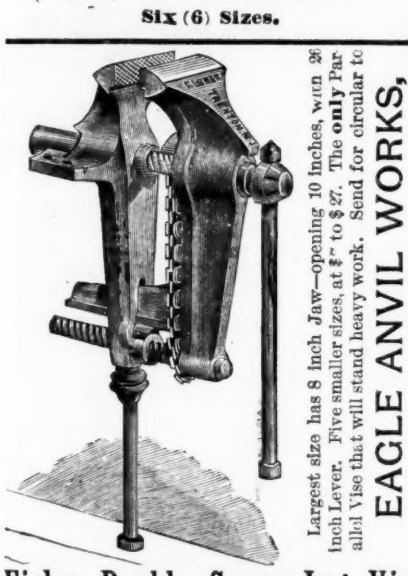

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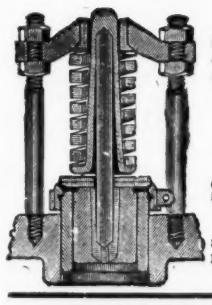

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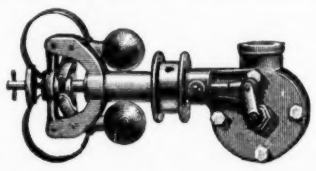

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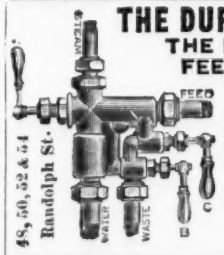

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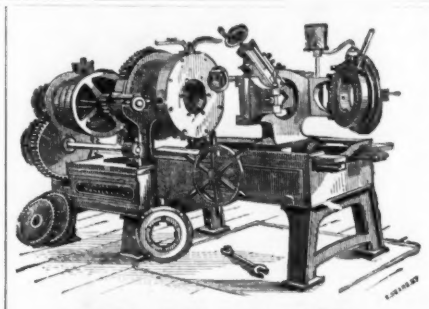

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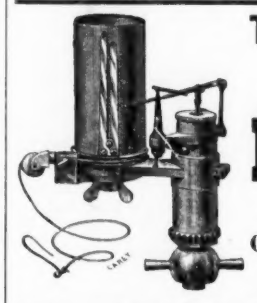

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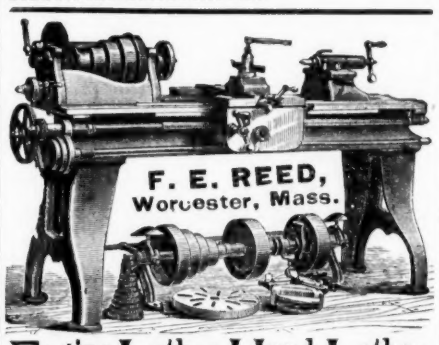

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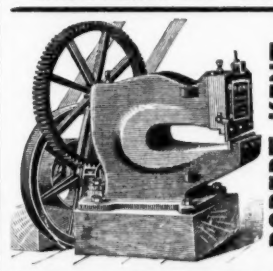

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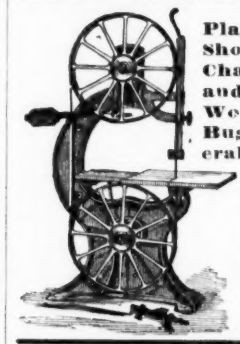

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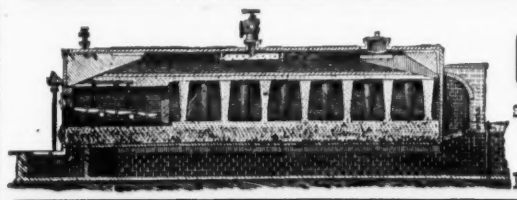

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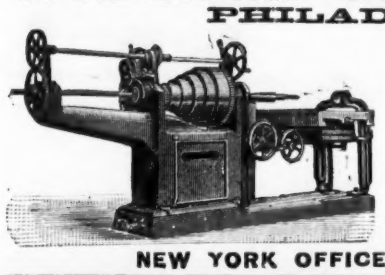

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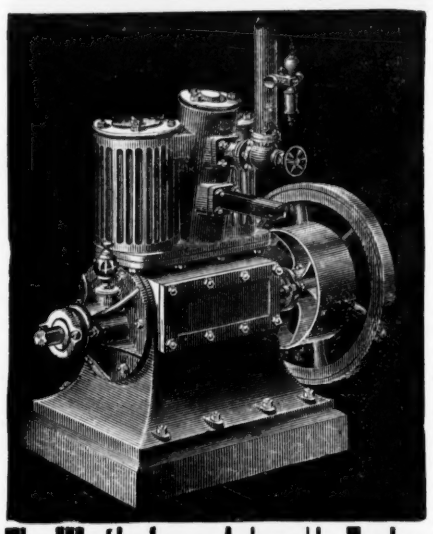

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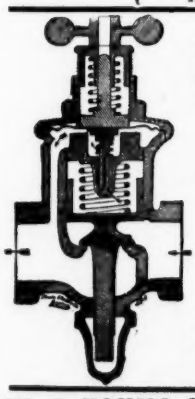

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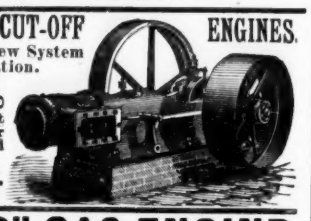

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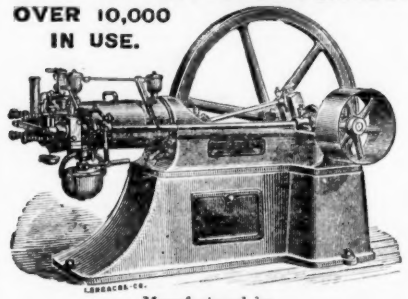

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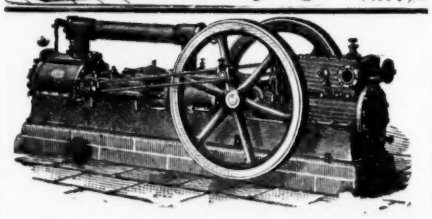

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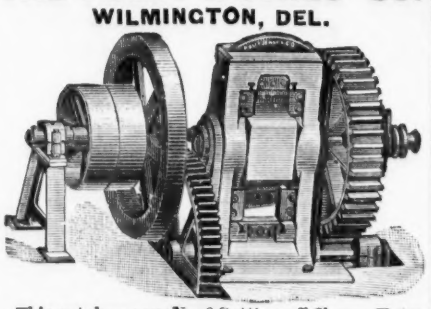

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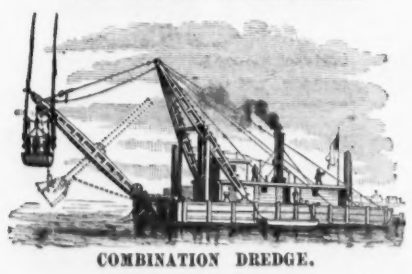

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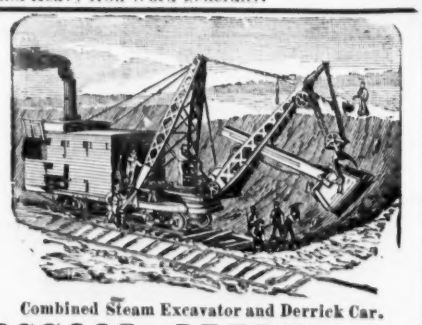

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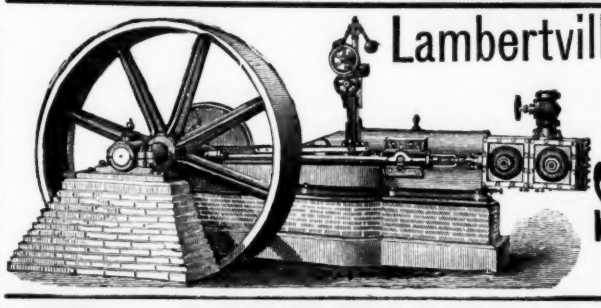

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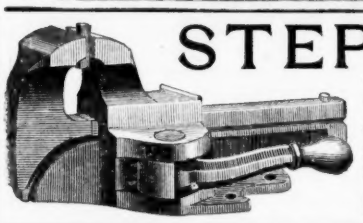

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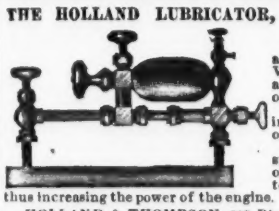

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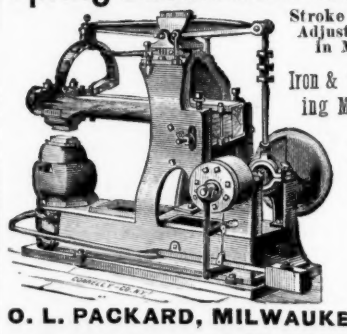

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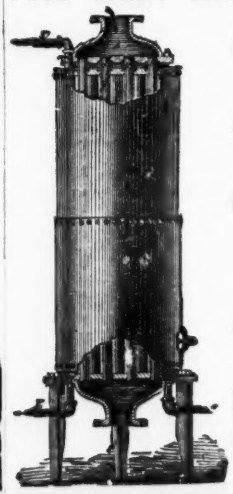

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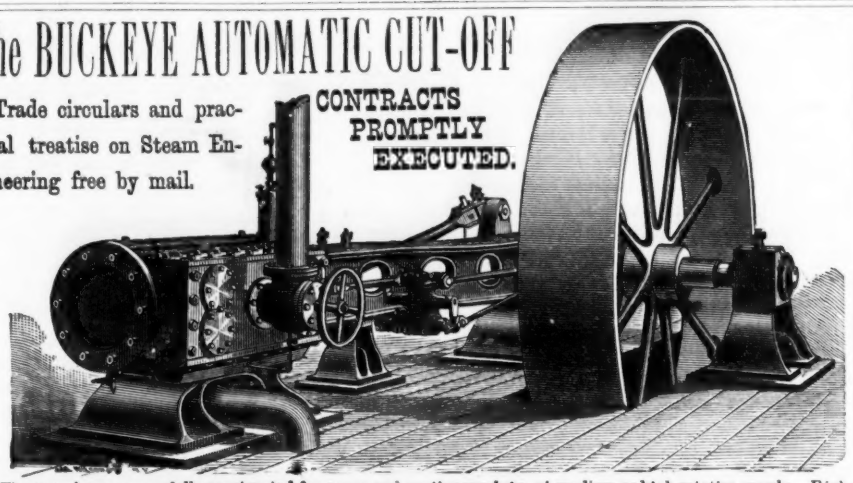

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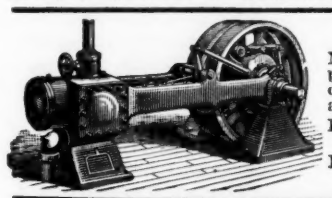

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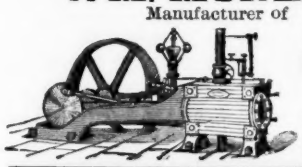

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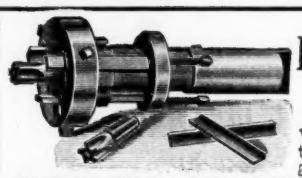

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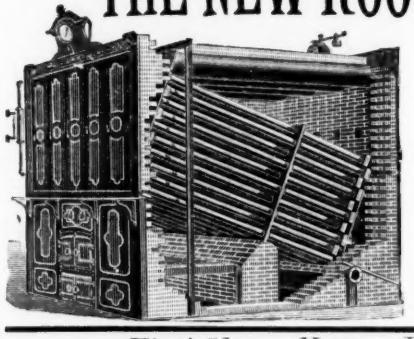

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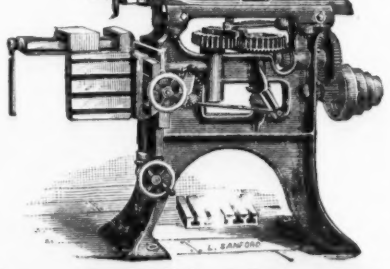

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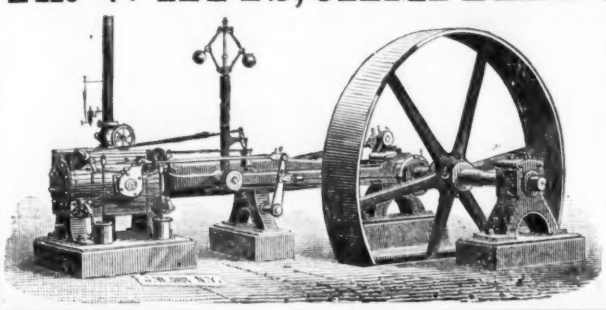

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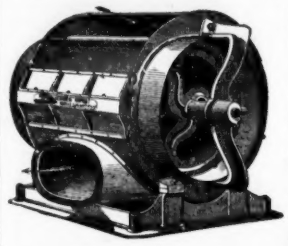

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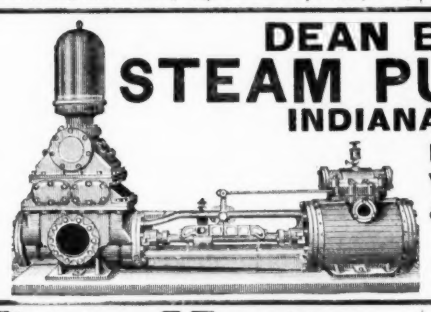

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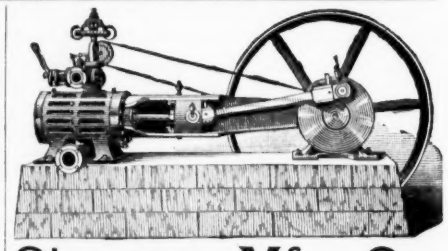

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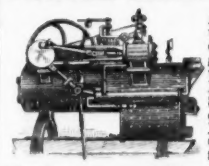

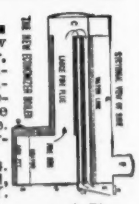

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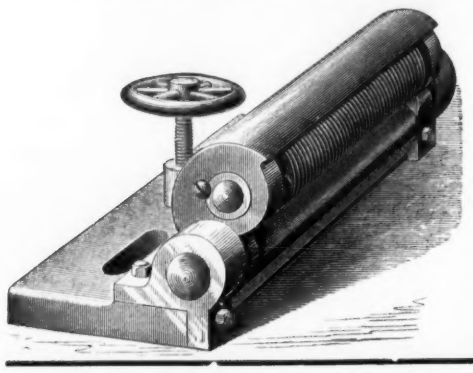
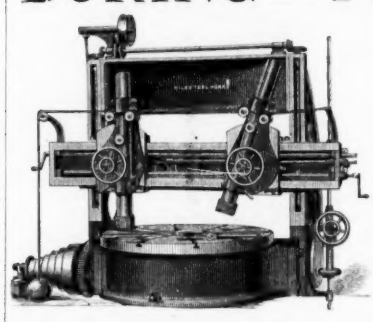


One of the most disagreeable things to be done in a workshop is the Truing of Grindstones. It is, therefore, often the case that they are allowed to become quite out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut illustrates a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically, without interfering with the constant use of the stone, and does the truing without raising any dust

BORING AND TURNING MILLS



5, 6, 7, 8, 10, 12, 14 & 16

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THE PRAY MFG. CO. reports—"Can bore and turn a Pulley 8 feet diameter, 26 inch face, trim the edges and face the hub in 8 hours, handling included."

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PORTER MFG. CO.—"We are using your mill for boring cylinders, and find it does quicker work and more accurate than any Lathe. Cylinders bored on this machine are absolutely perfect, as near as we can measure.

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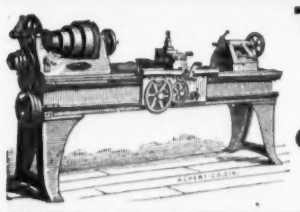

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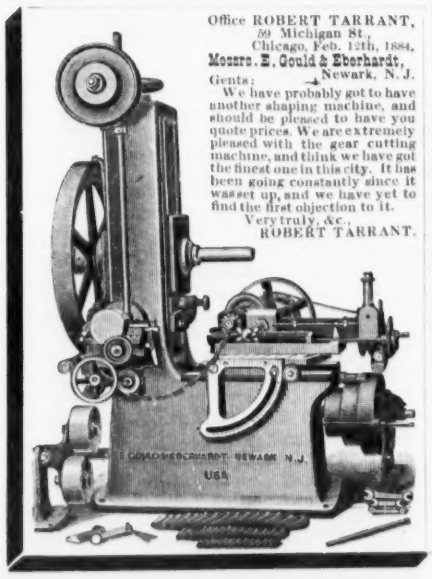

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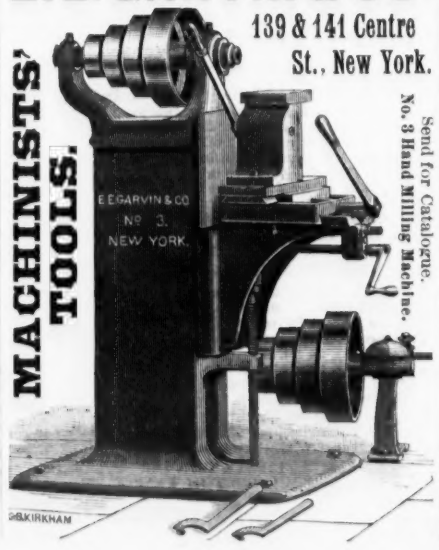

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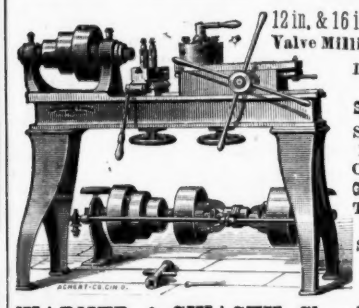

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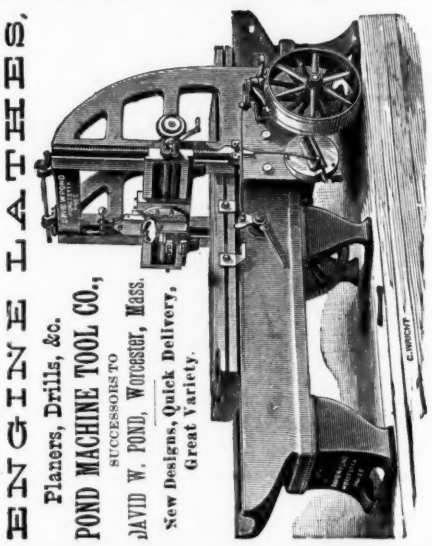

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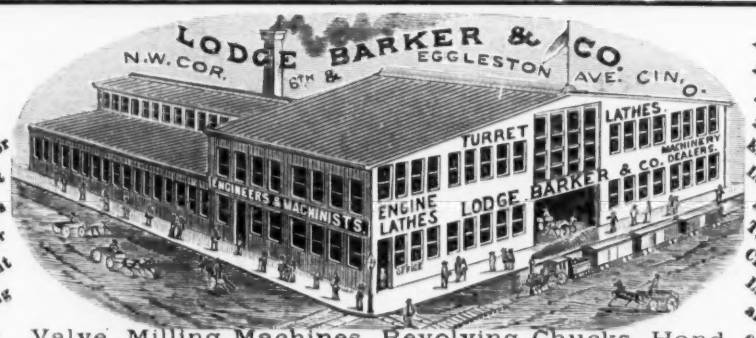

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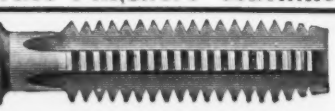

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